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MAIZE-GROWING IN THE BAY OF PLENTY.

PRESENT METHODS AND SOME SUGGESTED IMPROVEMENTS.

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THROUGHOUT the Bay of Plenty district, in individual areas ranging from one to over a hundred acres, maize-growing has been an established practice since the early days of local settlement. At one time it was regarded as the chief means of gaining a living from the land in the region stretching from Tauranga to Opotiki, but with the advances made by dairying maize-growing has lost some ground and is now only of secondary importance. However, with an aggregate area of approximately 6,500 acres devoted to this crop annually, it is still of some considerable consequence to the local farming community.

SOILS AND CLIMATE OF MAIZE-GROWING LOCALITIES.

That part of the Bay of Plenty which is largely devoted to maize-growing consists of the coastal strip, rarely exceeding a depth of ten miles. In the western portion, comprising the localities of Tauranga and Te Puke, the country is gently undulating and of light pumice nature. In favourable seasons and with liberal manuring this type of soil gives highly satisfactory results with the first crop after grass, but succeeding crops are usually disappointing.

Extending farther to the east are the Rangitaiki Swamp, Whakatane Flats, and Opouriao Valley, with soils of the peat, peat and pumice, and heavier river-silt types respectively. Very good crops of maize can be obtained on these soils, even in the second successive year of growing. All these soils, as would be expected, are level and rather low-lying, so that drainage in some cases is not satisfactory. There is then a break in the maize-growing belt, as for thirty miles the hills skirt the sea-coast. At the eastern end of the Bay one again comes on a fairly extensive flat area at Opotiki. This area comprises the river-flats built up by the Waioeka and Otara Rivers, and is particularly fertile. In fact, it is only approached in fertility by the Opouriao Valley among the maize-growing districts. In the Opotiki district there is also an area of lighter undulating hill country very similar to that of Te Puke and Tauranga.

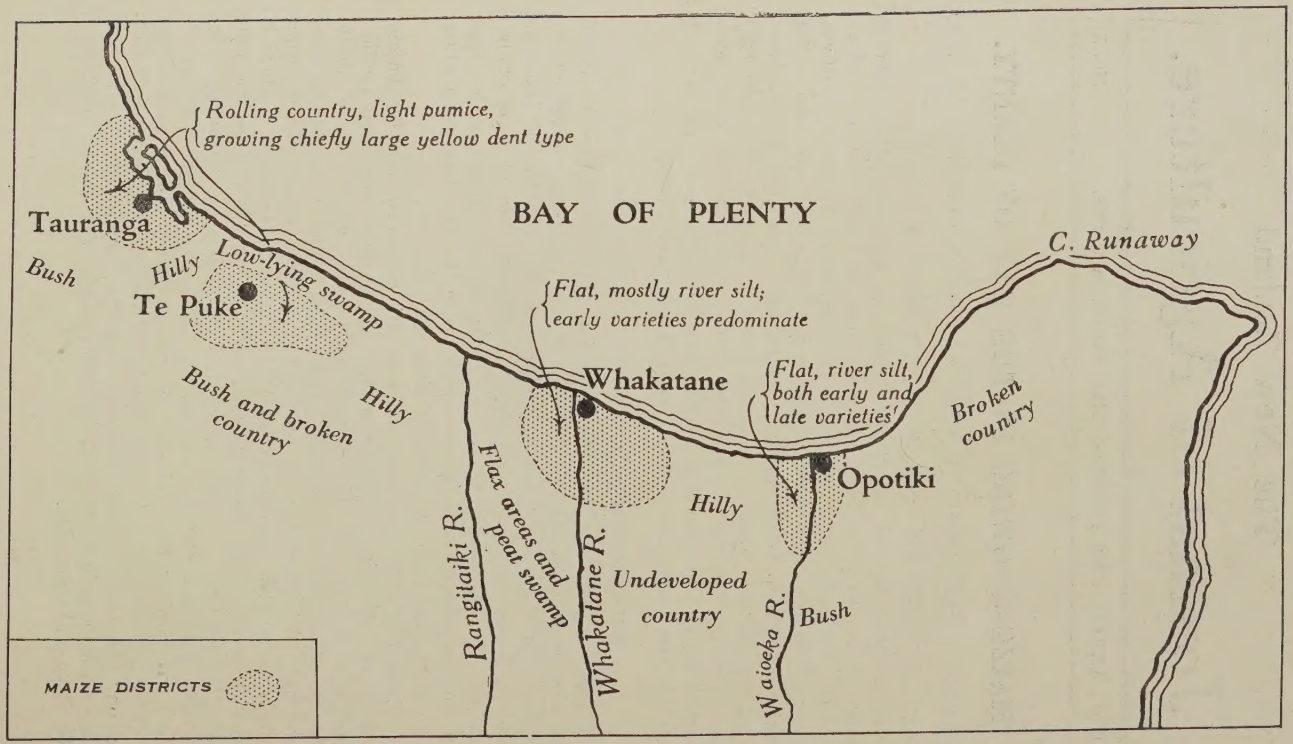

FIG. 1. SKETCH-MAP OF BAY OF PLENTY, INDICATING PRINCIPAL MAIZE-GROWING LOCALITIES AND NATURE OF COUNTRY.

Soil-conditions are therefore very varied in the maize belt, so that it is not possible to say that any particular soil-type is used in growing the crop. Undoubtedly, however, the most consistent results are obtained from the river-flats near Opotiki.

Climatic conditions throughout the maize districts vary to some extent with the soil-types. As would be expected, the lower country experiences heavier and more frequent frosts than does the higher hill country. Consequently it is found that the flats of Opotiki and Whakatane have a shorter growing season than does the hill country of Te Puke, Tauranga, and Opotiki. Moreover, the lighter soils are warmer and better drained, so that initial working can be done earlier in the season. This point is of considerable importance when selecting the variety to be grown in any district.

OTHER LOCAL POINTS.

Opotiki is generally regarded as the leading maize district, and has been the home of this crop for many years. Whakatane embraces a large area of comparatively new country which has not been devoted to maize, and the growers are more scattered than in the other localities.

So far as choice of varieties is concerned the Te Puke and Tauranga districts are practically identical, as both favour a rather slow-maturing type. There is, however, a difference in the method of planting generally adopted in each locality. Around Tauranga it is customary to plant on "the square," so as to allow of cultivation in two directions, whereas in Te Puke the usual method of continuous rows is adopted. There is a great deal in favour of the Tauranga system if annual weeds are troublesome, but with large areas it is not always practicable.

VARIETIES.

Speaking generally of the varieties in use in the Bay of Plenty, it can be said that these have become so intermixed that practically no varieties true to name are to be found. Originally pure varieties were introduced, but owing to these having been grown in neighbouring blocks, the identity of each was soon lost. At present there are only two distinct types grown. These are a late heavy-yielding type and an earlier lighter-yielding variety. Of the former it can be stated that very few strains are free from impurities, but with the latter there are several very satisfactory strains. This is no doubt due to the fact that the earlier varieties mature fully six weeks ahead of the late strains and so escape cross-pollination.

Late varieties in use are Horsetooth, Prairie Queen, and Hickory King. The first-named is the variety most generally grown. Prairie Queen is occasionally met with, but is obviously crossed with very late varieties. Hickory King is occasionally grown, but is more suited for green feed than for grain.

To instance the loss of identity suffered by a variety by crossing with others the Horsetooth maize can be taken. In this variety the grain should be long and narrow, resembling to some extent a horse's tooth, after which it has been named. But among the Horsetooth varieties grown and claimed to be true to type one often finds grain which is broad and shallow rather than characteristic of the variety.

There is obviously need, therefore, for better selection of seed in order to get back to the true type.

Of the early varieties Early Butler is by far the most popular, and it is practically the only variety grown that has been kept reasonably pure. Other varieties occasionally met with are Early Red Leaming, and Funk's Yellow Dent.

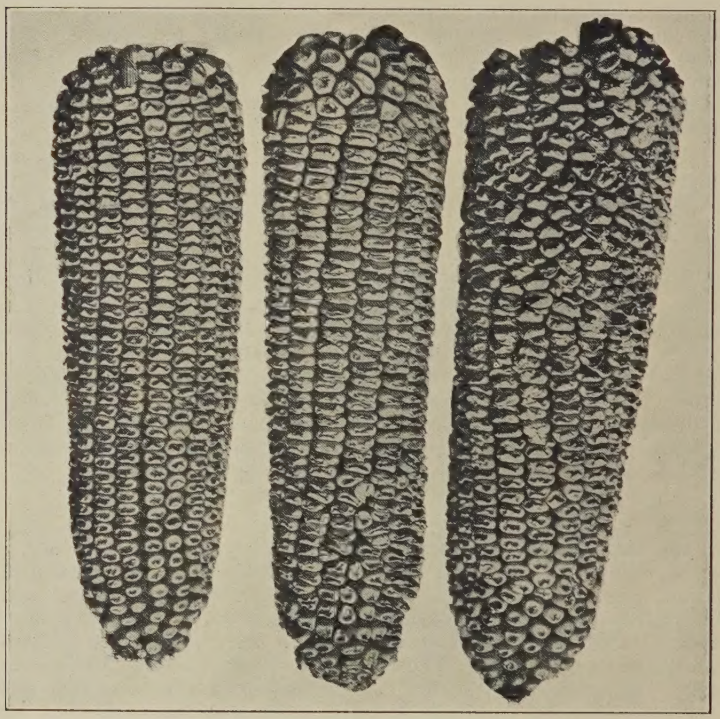

FIG. 2. HORSETOOTH MAIZE.

Late-maturing variety suited to the heavier soils, where high yields (up to 100 bushels per acre) are obtained. Most strains are now crossed with Early Butler or Prairie Queen.

[Photo by H. Drake.

The improvement of varieties has been taken up by several progressive growers in the Bay of Plenty, and they have met with considerable success. As a result they have established a reputation for seed maize which has extended of recent years to the Gisborne district, where a great deal of maize is also grown.

PLACE OF MAIZE IN ROTATION.

In the early days maize-growing, particularly on the fertile river-flats at Opotiki, was repeated on the same areas year after year without

any apparent loss of fertility. Only such rich soils, however, could stand this treatment, as maize is a particularly heavy feeder. On the lighter soils such a practice would soon become unprofitable, and there is evidence that it has had a detrimental effect upon the land for years after maize-growing had ceased. Generally speaking, maize should be the first crop after grass. On heavier soils of high fertility a second successive crop may be taken without creating any ill effects, but on light soils this should be avoided as far as possible.

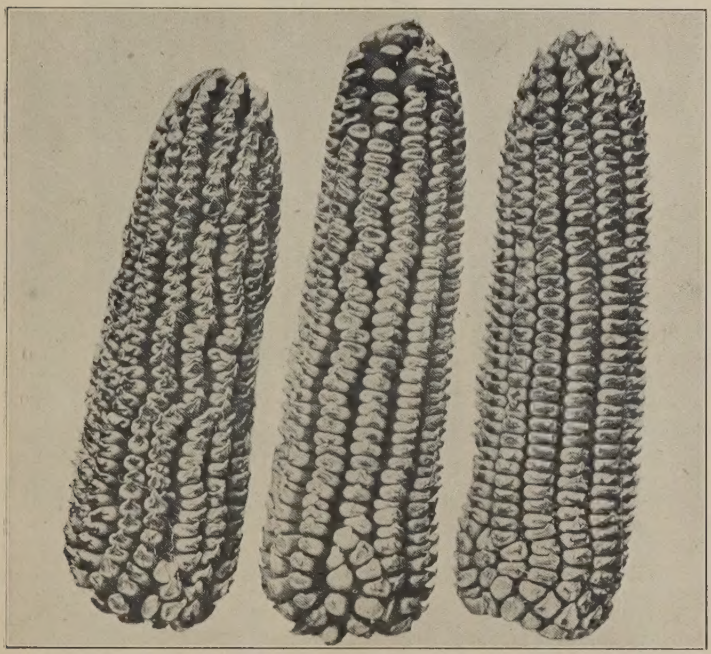

FIG. 3. EARLY BUTLER.

Earliest-maturing variety; favoured on good soils where season is short; poor yielder on light country.

[*Photo by H. Drake.*

Later in a rotation maize does not appear to do so well, as the crop appears to require first use of the humus ploughed in. On the light soils of the Tauranga district where it is desired to take a second and sometimes even a third crop it is the practice to sow lupins just prior to the last cultivation of the growing crop. After harvesting the crop these lupins are ploughed in, and they provide humus for the succeeding crop. This practice could well be exploited on all light soils, irrespective of whether a succeeding crop of maize is intended or not.

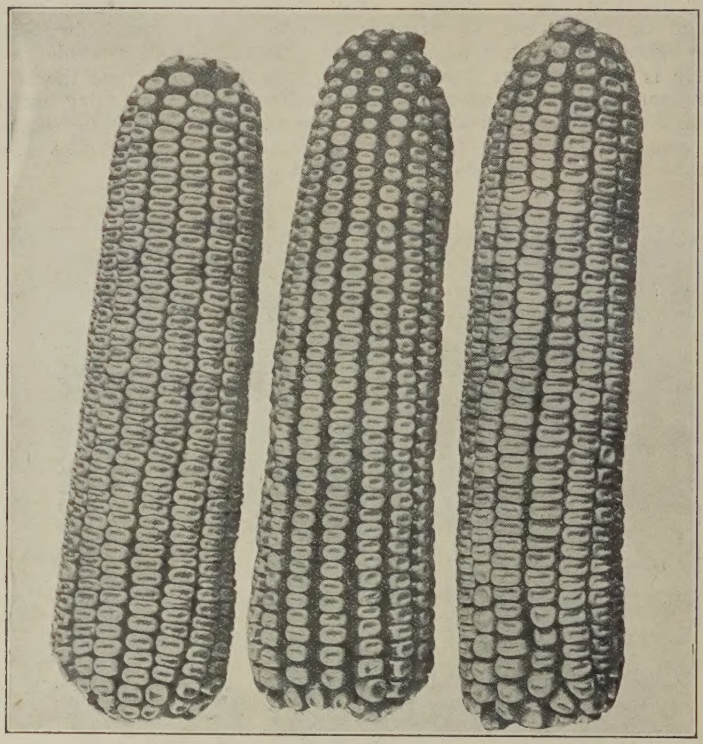

FIG. 4. EXCELSIOR.

Late-maturing variety, which does well on heavy soils. It has undergone more careful selection than any other existing strains in the Bay of Plenty.

[*Photo by H. Drake.*

CULTIVATION.

The Bay of Plenty farmer in general does not pay sufficient attention to the cultivation of his maize area. The usual practice is to plough from six weeks to one week before sowing, work the soil at once with disks and harrows, and sow with a double-row planter. Usually the initial ploughing is left so late that one operation follows the other as rapidly as the farmer can carry them out. On the lighter soils the surface is sometimes rolled just before and immediately after sowing, but this is not a general practice.

The lateness of the initial ploughing on land previously in maize can be attributed to the fact that the farmer grazes the old maize-stalks through the winter and early spring. Too much value is often placed on these for that purpose, and if instead they were ploughed in after harvesting, and the land allowed to fallow, it is believed that more payable results would be obtained. To cut the stalks up

sufficiently to be ploughed in cleanly, a chopper-roller would be necessary, but in the absence of this ordinary disks would be fairly satisfactory.

SOWING.

The rate of seeding varies with the method of sowing. Usually 14 lb. to 16 lb. is required to sow an acre when a double-row planter is used. With some varieties it will be found that 12 lb. will suffice, but this depends upon the space between the rows. With the taller varieties it is usual to space the rows at 3 ft., with a single plant at

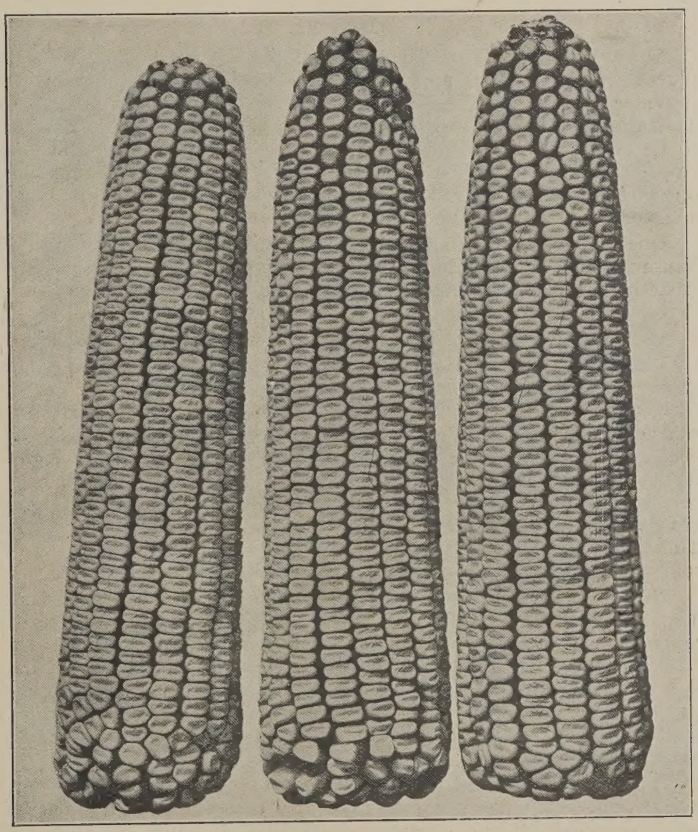

FIG. 5. A LARGE YELLOW DENT.

Variety commonly grown in Tauranga and Te Puke localities. Late-maturing.
[*Photo by H. Drake.*

approximately every foot. Shorter varieties can be grown in rows 30 in. apart, so it can be seen that more seed would be required to sow an acre in this case than with the taller varieties.

Where seed is sown by hand and on " the square," as in Tauranga, 10 lb. to 12 lb. is quite sufficient. The method of setting out the field for this work is as follows: A sledge with three runners spaced at 3 ft. intervals is drawn across the field in one direction until the whole area is covered. It is then drawn at right angles across the field, and at each point where the impressions of the runners intersect seed is dibbled in. Special hand-sowers are provided for this work, and it is estimated that a man can cover 4 acres in this way in a day.

MANURING.

Since the double-row planter has been in use it has been the practice to sow the manure with the seed at the maximum rate provided by this machine. Most of these implements are capable of a maximum of 3 cwt. to 4 cwt. per acre, so that this figure has come to be generally regarded as the quantity to be sown with the maize crop. Practically without exception this has been entirely superphosphate until recently, when special maize-manures containing in addition some nitrogen and potash have found favour.

One must bear in mind the special green-manuring adopted in the Tauranga area by the ploughing-in of lupins. This is undoubtedly a great help to the succeeding crop, whether it be maize or any other.

INTERCULTIVATION.

Intercultivation commences in some cases before the crop shows above the ground. Farmers on the lighter soils have to contend with rapid growth of spring weeds, and therefore many harrow the field a few days after sowing. This harrowing is usually a very light one. Later, when the young maize-plants are a few inches high, a further harrowing is given. This does not destroy as many plants as one would perhaps expect, but it certainly checks incipient weed-growth. It is usual to select a warm day for this work, as less damage is then done to the maize-plants than would be the case in cold weather.

As the plants grow stronger and when they are about 6 in. to 9 in. high the first scarifying is given. This is usually deep, as the roots of the plants have not by then spread very far outwards. Later, further scarifyings are given at intervals of two weeks, until the crop is too tall to cultivate without damaging the plants unnecessarily. These later scarifyings require to be done to a shallower level on account of the maize-roots spreading across the rows a few inches below the surface.

It is usual for a crop to receive six to eight scarifyings during a season, but many receive less than this number. Such crops are easily detected by the stunted nature of the maize and the rank growth of weeds.

HARVESTING.

The ripened crop is allowed to stand in the field until mid-winter. Once the grain has ripened and hardened off it is considered

advantageous to allow the crop to experience several winter frosts before harvesting. No damage is done to the grain then, and it is claimed that its quality is improved.

The actual harvesting is done by hand, the cobs being plucked from the stems by the farmer himself or by contract labour. It is usual where the area is extensive to let a contract to Maoris for the plucking and bagging of the cobs. Cartage to the maize-cribs is done in most cases by the farmer himself. The cost of harvesting when done by contract varies in different districts from 30s. to 45s. per acre. The higher rate generally rules for crops of Early Butler, which is rather severe on the hands.

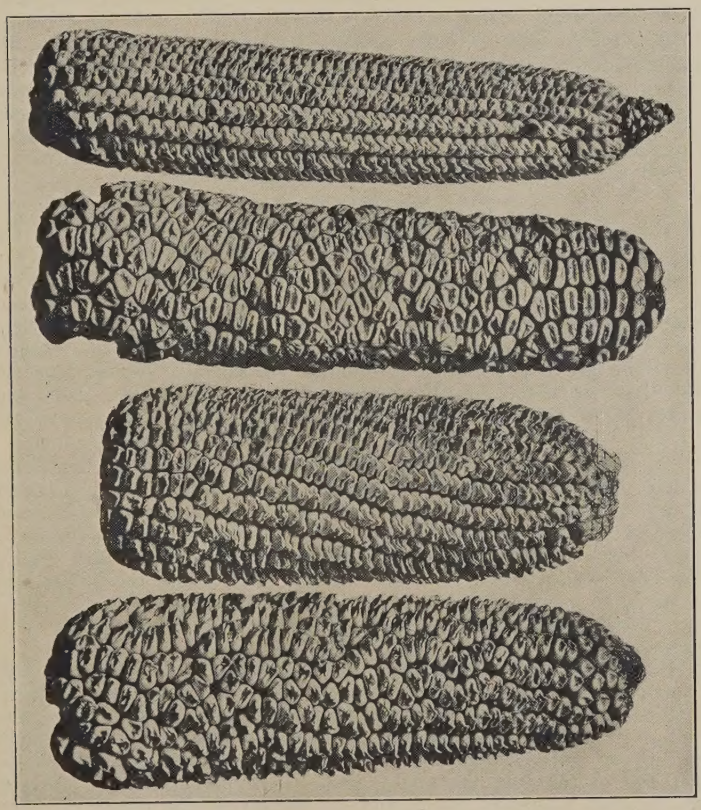

FIG. 6. MIXED TYPES, SHOWING NEED FOR SEED-SELECTION.

These cobs were taken from one crop, and represent only a few of the types which were to be seen in it.

[*Photo by H. Drake.*

SELECTION OF SEED.

Each year it is customary for the growers to select their seed maize as the cobs come from the shed to the sheller. Usually all the largest cobs are set aside for seed, and in doing so the farmer has no knowledge whatever of the conditions under which these cobs were produced. This is regularly reflected in the motley appearance of many of the crops, showing as they do irregularity in maturity, height, shape of cob, and type of grain.

Undoubtedly more care should be exercised, and if the farmer cannot spare sufficient time for field selection he should purchase seed from some reputable grower. There seems to be some objection to this owing to the cost of seed maize, but the farmer who objects to an outlay of 4s. per acre on seed maize will very often spend £2 per acre on oats for seed.

Where a reasonably good strain is held it would pay the farmer handsomely to select all his seed from the crop before harvesting. He is then in a position to select for uniformity of ripening, and will know that each cob was growing under ordinary field conditions. Such seed can be relied on to give more uniform results than does the seed selected in the old obsolete way from the crib.

YIELDS AND USES OF THE CROP.

Perhaps the greatest influence on the yield of maize crops in the Bay of Plenty is the position of the crop in the rotation. Where the land was previously in maize the yield is almost invariably lower than for the first crop, and on light soils this is very much more marked than on the heavier soil-types. Usually in the Opotiki area a yield of 60 bushels per acre is considered good, although yields of 80 bushels and more are not uncommon. Similar yields would be expected in the better parts of the Whakatane area, but around Te Puke and Tauranga, 50 bushels, with occasional yields in excess of 70 bushels, per acre would be the average.

At present about two-thirds of the maize produced on the farms is sold, and finds its way to suburban poultrymen and to pig-raisers in the Waikato. Of the rest retained on the farm, poultry, pigs, and horses are the chief consumers. Occasionally one meets a settler who grinds his own grain for calf-meal, but such cases are rare. This, however, is a direction in which the use of maize could perhaps be exploited to a greater extent.

CONCLUSION.

In concluding it may be said that, while maize-growing may still be a remunerative line of farming in the Bay of Plenty district, there are several directions in which improvements appear possible in the method of growing the crop, and the adoption of such methods should lead to an improvement in yields. Firstly, greater care should be exercised in selecting the seed; then better preparation of the soil for the crop should be given, and, as suggested, this might take the form of a winter fallow; finally, more careful selection of varieties according to climatic and soil conditions would be beneficial to the growers. Only by a combination of all such improvements in the growing of the crop can it be expected to give its maximum return.

FROST-PREVENTION FOR ORCHARDS.

EXPERIMENTS AND EXPERIENCES IN CENTRAL OTAGO, SEASON 1928–29.

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SEASONAL CONDITIONS.

The spring of 1928 in Central Otago was not a notably bad one so far as damaging frosts were concerned, though the district experienced some cold snaps as usual. The 8th and 9th September were bitterly cold, with snow falling on the ranges, and on the latter day there was sleet on the flats. The following morning there was a frost which did a certain amount of injury in a few low-lying spots. Apricots were then blooming freely, and it is probable that a considerable number of blossoms were damaged through the cold snap interfering with the work of bees. Following a cold spell, with several falls of snow on the ranges, frosts occurred on the mornings of 28th and 29th September. October opened warm, but another spell of cold weather, with snow falling on the high country, occurred, culminating in a light frost on the morning of the 16th. Again on the morning of 10th November there was a frost, preceded by falls of snow on the ranges. The frost alarm rang on each of these four occasions.

Field Tests at Alexandra.

Field experiments were continued during the spring of 1928 at the orchard of Mr. W. Bringans, Alexandra. Owing to illness Mr. Bringans was in hospital early in September, and therefore the firepots were not put out in the orchard until the 25th of that month. The previous cold snap of the 8th and 9th did considerable damage to his apricot-blossoms, which resulted in a light crop of this fruit.

The condition of the blossoms at this orchard on 17th September was as follows:—Apricots: Blossoms nearly all fallen; a few late ones still out. Peaches and nectarines: Full pink to one-third out. Cherry-plums: Commencing to fall. Plums: Mostly approaching open cluster. One variety of Japanese in full bloom. Cherries: Open cluster. Pears: Green tip to tight cluster. Apples: Green tip to tight cluster. Quinces: Foliage out, but no blossoms showing.

An endeavour will be made in the future to annually collect definite data regarding the blossoming-periods of the chief varieties of each class of fruit in this district. Such information, together with the amount of frost injury sustained, should greatly assist in ascertaining the more susceptible varieties and the degree of frost they will stand at various stages.

The area under protection was increased, by co-operation with Mr. Bringans, to 4½ acres, and consisted of all classes of stone-fruit. On this area 380 firepots were laid out in the same manner as described in the *Journal* for June, 1928.

On the morning of 28th September the alarm rang at 2.5 a.m., and at 2.30 a.m. the lowest temperature was 28·5° F. There followed a slight rise, and an hour later it was one-half to one and a half degrees

higher, according to the position of the thermometers. Soon after there was a fall, and alternate firepots (a total of 221) were lit at 4 a.m., the temperature being then 27° F. By 4.45 a.m. the temperature outside the experimental area was 28·2°, while inside we had raised it in the coldest spot to 30°, and the highest reading was 31·5°. The weather was calm, and until now the drift had been from the north; it then changed to south-east, to north-east, to east, and by 5.30 a.m. it was back to south-east, when the outside temperature was 28·8°, and the inside from 29·8° in the south-west corner to 31° in the north-east (the lee side). Throughout there had been a few clouds from the south to the north-east, the sun, which rose above the hill at about 5.45 a.m., being obscured until 6.30 a.m. At 6 a.m. the temperatures were practically the same as at the previous reading, with the drift from the north-west. When the sun appeared above the clouds the drift was from the north-east, and the temperature 31·2° outside and 32° to 33° inside the area. All fires were then immediately extinguished. With an average of only fifty firepots lit per acre the temperature was raised two to three degrees. The standard minimum temperatures for that night recorded at the Alexandra Climatological Station were 30° in the Stevenson screen at 4 ft. 6 in. level, and 20° exposed on the grass, whereas the lowest recorded under an ordinary shelter at the 4 ft. 6 in. level in the orchard was 27°.

The alarm again rang the following morning at 1.40 a.m., the previous day having been fine and sunny. At 2.20 a.m. the temperature had fallen, the lowest reading then being 26·5°, and 192 firepots were immediately lit over an area of about 3½ acres. By 2.55 a.m. the outside temperature was 26·8°, and varied inside from 28·8° to 29·6°. At 3.20 a.m. it was 27° outside and 29·1° to 30·2° inside. By 5.35 a.m. the outside temperature had risen to 28·8°, and inside it varied from 30° to 31°. The sun rose soon after, and all fires were extinguished. The weather was calm with an easterly drift most of the time, but with occasional changes all round the compass. The sky showed thin clouds around the east, south, and west most of the night. On this occasion again it will be seen that the temperature was raised with an average of fifty-five firepots lighted per acre. The standard minimum temperature recorded at the Alexandra Climatological Station was 29·7° in screen at 4 ft. 6 in. level, and 19·5° exposed on the grass, the lowest in the orchard, under an ordinary shelter at 4 ft. 6 in., being 26·5°.

On 16th October the alarm rang at 4 a.m., the temperature twenty minutes later being 29°. As the temperature gradually rose it was not considered necessary to light up, and by 5.20 a.m. the readings were all above freezing-point.

The alarm also rang at 4 a.m. on 10th November. The temperature remained at freezing-point for a very short while and then rose, thus obviating the necessity of lighting up.

It should be noted that all times given in this article are mean time and not "daylight-saving."

FROST-ALARM AND THERMOMETERS.

The alarm (Tycos) was erected at my home, and a number of experiments were carried out whenever there were frosts in the early

mornings in August. The idea was to ascertain at what height the alarm thermometer should be placed. At 4 ft. 6 in. from the ground (the standard level) the greatest variation from a thermometer placed under the ordinary shelter at the same height and in close proximity was 0·2°. At Mr. Bringans's, therefore, it was placed at this height in a much more exposed position than it had been in the preceding year's experiments, and proved quite satisfactory. Each grower must find out the correct height for himself by placing the alarm at such a height above the ground as to cause it to ring when the temperature in the coldest part of his orchard reaches about 32° under an ordinary shelter at 4 ft. 6 in. from the ground.

All thermometers were tested prior to the experiments. The stems were placed in ice and water in a bucket, and each thermometer marked with any variation it showed from 32° F. The greatest error only proved to be 0·2° at that temperature.

Experience with Apricots at Earnscleugh.

I am indebted to Mr. J. R. Laing, of Earnscleugh, for particulars regarding his heating operations last spring. Preparations had been made for protecting his fruit crops (stone and pip) on a large scale, but the areas which needed heat were only two small separate blocks of apricots totalling 2 acres in extent. On these were distributed 150 firepots on lines previously suggested by me. On the morning of 28th September, the Tycos frost-alarm rang at 2.40 a.m. (over half an hour later than at Mr. Bringans's). At 2.50 a.m., with the temperature at 28° F., Mr. Laing commenced to light up—first all around the outside, and then alternate pots inside, completing at 3.30 a.m. At 4 a.m. the temperature had dropped to 27° outside the areas, and inside it had risen to 32° F., there being a south-west drift. At 4.45 a.m. the outside thermometers registered 28°, and at 5.10 a.m. 32°, while inside the areas the temperatures ranged from 32° to 33°. At this time there were heavy clouds in the east, some of which would probably be accounted for by the orchard fires at Mr. Bringans's. A sudden drop outside to 28° occurred at 5.55 a.m., and inside the temperature decreased to 30°. Lights were extinguished at 6.30 a.m., when the sun had risen above the clouds.

That night the alarm rang at 11.45. At 1.15 a.m. (29th) the temperature was 28°. Alternate firepots were then lit, the operation being completed by 1.40. The temperature at 1.50 was 30°, with no air-drift but clouds appearing in the north-west. At 2.50 the temperature outside was 29°, and inside 31°; the sky was clouding over and the drift was from the north-west. At 4 a.m. the rest of the firepots round the outside were lighted, and at 4.45 all heaters in these areas were alight, the thermometers registering 29° outside and 31° inside. Mr. Laing commenced extinguishing the fires at 5.30 and completed the operation at 6 a.m.

A minor frost occurred on the morning of 16th October, when the heaters were lit for two hours. The temperature varied from 28° to 31° outside, and did not drop below 31° inside the heated areas.

It will be seen, therefore, that Mr. Laing, during the three firings, consistently raised the temperature from two to five degrees, and thus

saved his crop, for no damage occurred to the apricots in what are considered very susceptible blocks, and a full crop, the only good one for some years, was harvested. Approximately two barrels of oil were used in each of the first two heatings, and one barrel in the third one.

Protection of Tomatoes at Earnscleugh.

Mr. W. H. Hinton, of Earnscleugh, has kindly furnished me with data concerning the protection of eight thousand tomato-plants in the past autumn. A heavy crop still remained in mid-March, so he placed 250 firepots among them. There were fifty rows of approximately one hundred and fifty plants in each, the rows being 3 ft. 6 in. apart. Down each alternate row ten pots were placed at even distances. Three standard minimum thermometers were placed 1 ft. from the ground on boxes one near each end of the plot and one in the centre. The alarm thermometer was situated 3 ft. from the ground on a post in the lowest spot in the area, and connected with the batteries and bell in Mr. Hinton's bedroom.

The first call was received at 2 a.m. on 1st April, the alarm thermometer registering 31° F. and those in the plot 31·5° (top end), 31·5° (centre), and 30·5° (bottom end). Mr. Hinton's idea was to wait until four degrees of frost was registered on any one of the thermometers. To test what one man could do he refrained from calling up any one else, and while waiting he took off the lids. The danger-point was reached at 5.30 a.m., when he ignited his torch and immediately lit the outside pots all round, then alternate pots in each alternate row. One hundred and thirty pots were thus alight within twelve minutes. Within a very short space of time the centre thermometer rose three degrees—namely, from 29° to 32°. The end thermometers did not register such a rise except when the drift was in their direction. The temperature was held in the centre of the plot until 6.30 a.m. (half an hour before sunrise—the coldest time) when it was thought advisable to completely fire alternate rows, making an extra sixty pots, or 190 in all. This was found to be sufficient to keep the temperature not lower than 29°, while the lowest outside the heated area was 26°. As a check thirty plants in a sheltered spot against the wall of the house were left unprotected, and these were distinctly frosted, whereas those in the heated area were almost untouched, only a few around the outside being slightly nipped. This frost did very heavy damage to tomato crops around the district where they were not protected. The air-drift was from all quarters, and carried the heat first in one direction and then in another, with the result that ice formed rapidly on the outside rows until such time as the drift changed—the matter generally of only a few minutes. Although ice was thus formed it never remained long enough to penetrate the fruit therefore causing practically no damage. Mr. Hinton noted that when the pots were alight the cold air rushed in from both ends. The rows of plants—5 ft. high—acted as a funnel and carried the heat away too quickly into the air. Probably on this account more pots had to be lit than should otherwise have been necessary. To overcome this difficulty he put up a scrim shelter 6 ft. high at each end for subsequent heatings.

The next severe frost occurred a fortnight later, by which time another 250 cases of the crop had been harvested. The erection of the scrim shelters at each end proved very successful. With the same amount of frost as on the previous occasion — namely, six degrees—the lowest temperature recorded on the centre thermometer was only two degrees of frost, as against three degrees without the scrim.

There was another frost a week later when nine degrees of frost was registered outside and a minimum of two to five degrees inside the heated area. The latter figure was only touched for a very short period just before sunrise, the temperature most of the time being 29° and 30°. All the firepots were lit for three hours, and only slight damage was done. This was undoubtedly a very fine save; no doubt the holding of the temperature for most of the time at not lower than 29° and 30° was the great factor. Had the temperature been allowed to fall to 29°, or below for any lengthened period, and then followed by a sudden drop, considerable damage must have occurred.

The prospects were for heavier and nightly frosts, so the plants were stripped and a heavy crop gathered and stored, as it was considered there would be no further gain by protecting them. It may be noted here that although the firepots were only 1 ft. away from the plants these did not suffer scorching.

If comparisons are made between the protection of fruit-trees and tomatoes it must be remembered that the latter are a ground crop. If readers will refer back to my previous series of articles on frost-prevention they will find considerable reference to "temperature inversion"—in ordinary parlance, the phenomenon of the frost being heavier near the ground than it is, say, some feet higher up. For these reasons the alarm thermometer was placed for tomatoes at 3 ft. from the ground, and the other thermometers only 1 ft. above ground-level. In the protection of fruit-trees against frost all thermometers are placed on the 4 ft. 6 in. level.

Future Prospects and Investigation.

That this system of protecting orchards and garden crops from frost injury is likely to become a permanent feature in orchard operations among the better growers of Central Otago who suffer such losses appears more than likely. Two years ago no provision of any kind was made; last season there was sufficient apparatus in the district to protect about 44 acres, made up as follows, the number of firepots being given in parentheses: J. R. Laing, 16 acres (1,000); W. H. Hinton, 15 acres (900); W. Bringans, 5 acres (380); C. McIntosh, 2½ acres (200); J. R. Forrest, 2½ acres (200); E. Goodall, 1 acre (100); M. P. McGinnis, 1 acre (100); R. Kinnaird, 1 acre (100). This represents protection for about six thousand trees.

All growers interested in protecting their orchards from frost injury would be well advised to become regular subscribers to this *Journal*, and to procure back numbers for June, July, and August, 1928, in which were published a series of illustrated articles on "Frost-prevention for Orchards," covering experiments carried out, costs, suggestions, &c.

At present, unless strong arguments are induced in favour, I am not prepared to recommend a continuance of the experiments in their present form but rather to consolidate the experience already gained. As noted above, a number of growers have now the necessary apparatus, and I am inclined to think that more good can be done by keeping in touch with these men, assisting them with advice, helping them in their operations, and watching and noting the results obtained.

The smoke-bombs for creating a smoke screen against the rising sun, which were forwarded to me, are still on hand, a favourable opportunity for trying them not yet having occurred. For a successful trial very careful thought and management will be necessary to obtain accurate results. The thermostat alarm will also require testing as opportunity occurs, for a suitable trial could not be arranged last season.

ALEXANDRA CLIMATOLOGICAL STATION.

The establishment of this station under the Dominion Meteorological Office, which was forecasted in a former article, is now an accomplished fact. Through the co-operation of the Alexandra Borough Council, who supplied a plot in the recreation reserve rent-free; the Central Otago Fruitgrowers' Association, who purchased and erected the fencing; the Meteorological Office, who supplied the instruments; and the Public Works Department, whose officer (Mr. George Smith) records the readings twice daily, a station of a high order has been established. From the viewpoint of frost-prevention the information thus gathered will prove invaluable in supplying records of temperatures, ascertaining conditions conducive to frost, and forecasting frosts and the degree of severity anticipated.

I desire again to acknowledge the assistance afforded me by Mr. Bringans, his family, and many others, which conduced to the undoubted success of the experiments. My thanks are also due to Messrs. Laing and Hinton for the interesting material supplied regarding their own experiences, which is embodied in this article.

Wool-branding Fluids.—During the past official year some further samples of wool-branding fluids on the market were examined at the Agriculture Department's Chemical Laboratory. No tarry matter or other harmful ingredients were detected.

Casein Manufacture and Grading.—The quantity of casein graded for export by the Dairy Division during the year ended 31st March, 1929, was slightly less than for the preceding twelve months, the figures being 1,890 tons and 2,233 tons respectively. Approximately 80 per cent. of this total consisted of lactic casein, the balance of 20 per cent. being of the rennet variety. Quality was of a very high standard. During the year a plant for drying casein was established at Midhirst, in Taranaki, the finished article being graded and shipped at New Plymouth. In addition the grading of casein is carried out at Castlecliff and Auckland. The grading of casein is optional, but at the request of manufacturers it has been the practice of the Dairy Division to grade all lines offering for shipment. No fee was charged in the past for this service, but during the year it was decided, in order to bring the grading into line with that of butter and cheese, to charge a grading fee of 1½d. per hundredweight, and this came into operation as from 1st February last.

ENSILAGE ON THE FARM.

METHODS OF MAKING AND HANDLING.

J. W. DEEM, Director of the Fields Division.

GENERAL CONSIDERATIONS.

THE making of ensilage should be an important feature in the farm-work of a great many districts of New Zealand, but especially in those where the weather is tricky and the making of good hay is a doubtful undertaking and a source of worry to the farmer. Even in districts where fairly good hay can be made it would be a better paying proposition to turn a portion of the available hay material into silage. Ensilage has this great advantage over hay, that it can be made just when the material is ready. Weather conditions do not interfere to any great extent, as, unless it is actually raining hard, the work need not be held up; showery weather is not hurtful, except that it increases the weight of the material to be handled.

Ensilage has the further advantage over hay that a great deal of rough material, such as coarse grasses, thistles, &c., which would not make palatable hay, will make fairly good useful silage, as the process of curing softens the hard stems and makes the material edible. At the same time it must be pointed out that poor material will not make the best ensilage; as with other crops, the better the material the better the results. A good stack or pit of ensilage is the best insurance policy a dairy-farmer can have on his farm. If not required at once it will keep for several years when properly made.

Ensilage will be found invaluable for all classes of stock, but especially for dairy cows, to take the place of roots and hay during the autumn, winter, and spring. For feeding to cows a month or two before calving it cannot be excelled. Experiments show that cows fed on good ensilage will give almost if not quite as good a return as when fed on the best of roots and green fodders. Cows fed on ensilage have a mellow appearance as compared with those fed on hay. Their skins are softer and looser, they calve and clean up better, and come to profit quicker.

An objection to ensilage is the cost of handling the mass of green material as compared with cured hay. If, however, a mechanical stacker is used for hoisting, and sweeps or sledges employed for carting the material to the stack, the labour is greatly minimized; in fact, under these conditions it would often be less than that necessary to make hay. The material would be saved at its best and the worry of haymaking eliminated. It must be recognized that a great deal of the so-called hay saved in many parts of New Zealand has been so spoiled by the weather that by the time it reaches the stack it is little if any better than badly saved wheat-straw.

MATERIALS FOR ENSILAGE.

Having decided that it is good farming practice to make ensilage, the next consideration is the best material to use.

Good pasture-growth of grasses and clovers mixed in fairly even proportions is hard to excel, and if properly saved the resultant silage

is almost perfect. Among the special crops, oats, wheat, barley, maize, and millet or sorghum, in conjunction with tares or peas, make about the best combinations. Any of the cereals, maize, millet, or sorghum will make good ensilage by themselves, but the addition of tares or peas increases the protein content and a better balanced ration is produced.

Lucerne also makes good ensilage, but being very rich in protein it is better mixed with grass, millet, or maize to make a more balanced fodder. Lucerne-growers frequently find a difficulty in disposing of the first cutting from a field in the spring. As this cutting generally contains a good deal of foreign matter in the shape of grass, weeds, &c., it makes good ensilage without the addition of other mixtures, and there is no better way of dealing with it.

On a great many farms there is a surplus of grass towards the end of November. This can with great advantage be cut and made into ensilage. Besides producing a quantity of good silage the removal of this grass will greatly benefit the pasture by allowing the clovers and finer grasses to come away and form a dense green covering.

Of the special crops, temporary pasture consisting of Italian rye-grass (20 lb. per acre) and red clover (6 lb.), and wheat or oats (2 bushels), in conjunction with tares or peas (1 bushel) are probably the best. The wheat or oats and tares may be sown in the autumn, fed off during the winter and spring, and then allowed to run for a crop, being ready for cutting early in December. Peas are first-class for spring sowing, but do not stand the winter and feeding if sown in the autumn. A mixture of peas (1 bushel) and beans (2 bushels) is also a good ensilage crop; likewise millet (16 lb.) or maize (2 bushels), but, as already mentioned, millet or maize is better when mixed with a legume like lucerne or peas. Peas may be grown in conjunction with either millet or maize, or an area of one of the latter crops and an area of peas grown separately and mixed when stacking. This usually gives the heaviest crops.

As in the making of good hay, material for ensilage should be cut at the right time if first-class silage is desired. Mixed grasses should be cut when the predominating varieties are in bloom; cereals just when the grain is thickening from the milk to the dough stage; maize when the cobs are taking on a glazed appearance, and peas and tares between the blooming and early podding stages.

METHODS OF ENSILAGE-MAKING.

There are three main methods of making ensilage—the silo, the pit and/or trench, and the stack.

The Silo.

The silo has many advantages, especially if it can be erected in a central position so as to minimize the carting of green material. It should be fitted with a cutter and blower or elevator for economy in filling. It is better to have two medium-sized silos than one large one. This enables the farmer to be filling one while the other is being used, which is a great advantage where silage is being used for summer feeding, and when small quantities of material are available from time to time. If possible a site should be chosen where a fair depth of the silo may be let into a bank. This secures economy in erection and in subsequent hoisting of material.

The Pit or Trench.

Where suitable banks are to be had in handy positions the pit is a very fine method of making ensilage, and frequently one can be provided in each field or where it will serve two or three paddocks. In choosing the site for a pit care should be taken to see that it can be conveniently filled from above, and that good access can be had from the front of the pit for carting out the material. The site should also be free from the danger of ground-water seeping into the pit. A round pit is much better than a square one, as it is difficult to fill the corners satisfactorily in the latter so as to exclude the air, and there is generally considerable loss from this cause. The walls should have a slight batter, 1 in 15 being about right. The opening to a round pit should if possible be just wide enough to allow a dray to

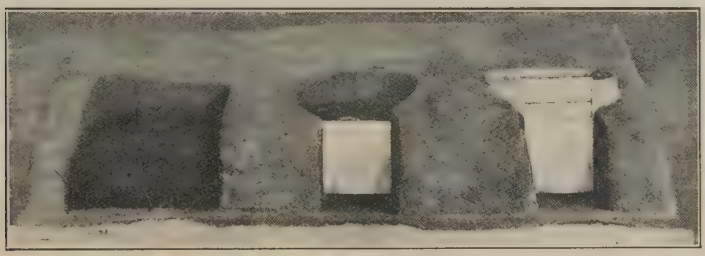


FIG. 1. MODELS OF DIFFERENT TYPES OF PIT.

On left—square pit (undesirable type); centre—ordinary round pit for temporary use; right—permanent round pit, with shoulders reinforced and concrete ring on top to extend capacity and carry roof.

back in, and where the pit is to be permanent the corners of the opening should be cemented so as to carry timber to close the opening as the pit is being filled. In the case of a temporary pit a good stout post may be placed at these corners. The timber for closing the opening should not be less than 2 in. stuff. In filling a pit great care should be taken to see that it is evenly filled and that the sides are well tramped, so that there is no possible chance of the material losing contact with the walls and admitting air. The same precautions are necessary in filling the pit as in building a stack to ensure that the temperature is properly controlled.

The approximate holding-capacity of round pits or silos of different sizes is as follows:—

Height (Feet).	Diameter (Feet).	Capacity (Tons).
20	10	30
20	12	45
24	12	55
20	14	60
30	12	75
30	14	100

Within reason, height should be sought in ensilage pits and stacks. An unduly shallow pit or low stack means an increase in the amount of surface for a given volume of material, with a corresponding increase in wastage; more weighting-material is also required to be placed on the top of the stack.

FIG. 2. IDEAL SITUATION FOR ENSILAGE-PIT.

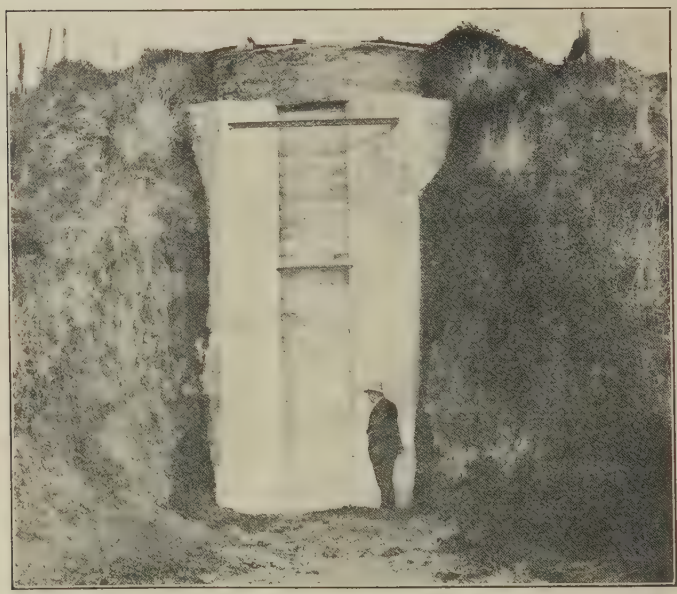


FIG. 3 PIT WITH CONCRETE FACINGS AND TOP, SITUATED AS SHOWN IN FIG. 2.

Trench pits for ensilage are frequently dug on the level, a spot being selected with just sufficient fall to prevent surface water running in. This method is used very extensively in Australia. A trench 66 ft. long, 21 ft. wide, and 6 ft. deep will hold approximately 100 tons of silage. Excavating is usually done by means of a plough and scoop. The ends of the trench should have a batter of 1 in 1 to allow of easy filling and emptying by driving right through.

A modification of this system is largely practised in the Waikato district, and the following description is supplied by Mr. P. W Smallfield, Fields Superintendent, Auckland :—

The pit is dug in from the edge of a low hill and made with rounded corners to facilitate the packing of the silage. The pit illustrated in the diagrams (Figs. 4 to 42) is 33 ft. long by 14 ft. wide by 8 ft. deep. The batter on the sides is 1 in 8, but more batter may be required on soils that are liable to slip. The depth of the pit will depend on the height of the permanent water-level in the locality, and the bottom must be above this level. In some soils pits can safely be made 10 ft. to 15 ft. or more deep. The bottom of the pit is sloped outwards to give drainage, and in the centre is a concrete roadway running up two-thirds of the length of the pit to allow of the carting out of silage during wet weather.

The turf and soil taken from the top of the pit during digging operations should be used to build up the surface of the land at the edges of the pit, so that rain-water from the hillside will not run in, and to level the ground all round the pit to facilitate filling operations.

The entrance to the pit is boarded up to prevent the silage stacked in the pit creeping away from the sides. When silage creeps away from the walls air enters and a layer of waste occurs round the sides of the pit. The entrance is boarded up by means of 6 in. by 2 in. planks carried 4 ft. or 5 ft. above the ground-level. The planks are placed against three 4 in. by 4 in. posts, which are sunk in concrete. Behind and at the sides of the two end posts a thin mixture of concrete should be run in between the posts and the earth wall, so that the back of the posts is tightly packed. Each end post carries a 4 in. by 1 in. batten to which is fixed a piece of 2 in. by 1 in., so as to make a slot, down which the 6 in. by 2 in. planks can be dropped and kept in position while the pit is being filled. The centre post is fitted loosely into a hole lined with concrete, and can be removed when the pit is being emptied. When the post is removed and carting operations are in progress the post-hole is covered by a piece of board (6 in. by 6 in. by 2 in.) which fits in a groove at the top of the hole. The tops of the three beams are held together by a 4 in. by 4 in. beam fastened to the posts by means of carriage-bolts. The three posts are stayed by 4 in. by 4 in. struts, the centre post by a strut supported in a slot in the concrete floor and fastened to the centre post by a carriage-bolt, and the side posts by struts fixed in the bank wall.

The Stack.

On the average farm the stack system will probably be the one followed by a majority of farmers for a long time to come. Its great recommendation is that the stack may be built in any field where the material is grown, which means a great saving of haulage.

In building an ensilage-stack it is very important that the farmer should have a fair idea of the quantity of material he has to put into it and the size of the stack required. The following figures will be useful : A good average crop of meadow hay will provide about 7 tons of green material per acre ; a fair crop of lucerne or temporary pasture

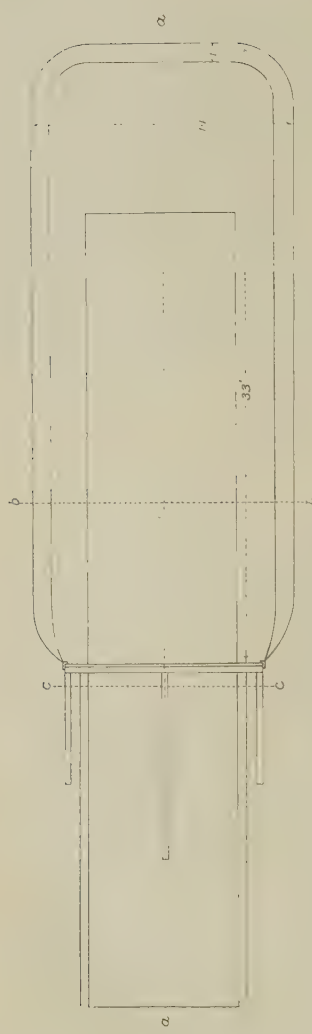


FIG. 4.—PLAN OF PIT TO HOLD 60–65 TONS OF SILAGE.

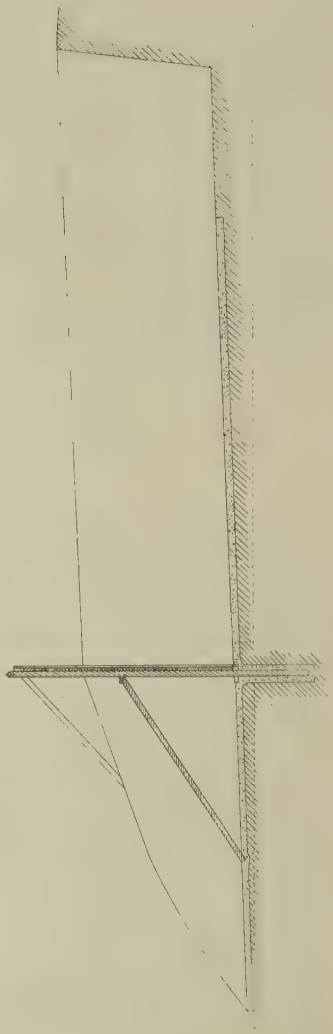


FIG. 4A.—SECTION THROUGH *a a* OF FIG. 4.

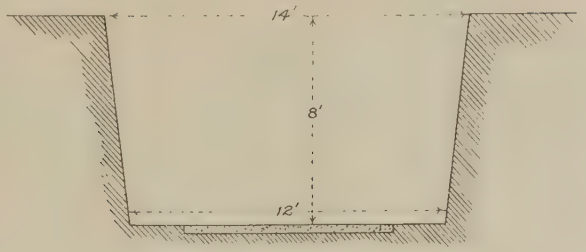


FIG. 4*b*. SECTION THROUGH *b–b* OF FIG. 4.

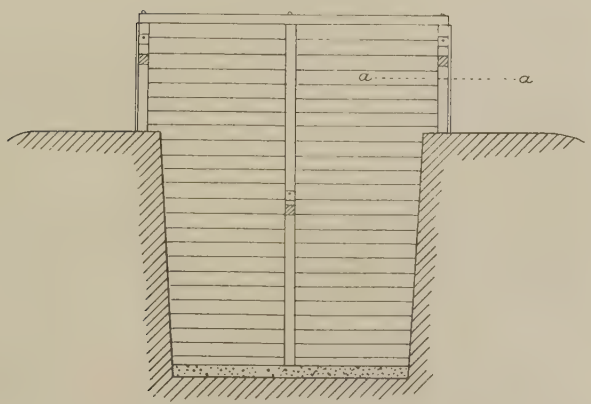


FIG. 4*c*. SECTION THROUGH *c–c* OF FIG. 4

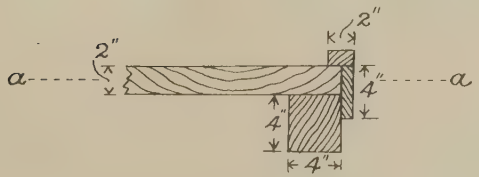


FIG. 4*d*. DETAIL *a–a* IN FIG. 4*c*.

7 to 9 tons, and good crops up to 10 or 12 tons; special crops of cereals or tares or peas about 10 tons, with extra-good giving as high as 12 to 14 tons; millet 12 to 16 tons; and maize about 30 tons, with extra-good crops running up to as high as 50 tons. About 20 tons is the minimum amount of material which should be put into an ensilage-stack. The approximate sizes of stacks are: 20 to 40 tons, 14 ft. by

14 ft.; 50 to 70 tons, 16 ft. by 18 ft.; 80 to 100 tons, 20 ft. by 24 ft. If reasonably good methods of saving are employed, each 30 tons of green material put into a stack should result in at least 20 tons of sound cured ensilage after allowing for all wastage.

Where very large quantities of material are being put in, a good square stack is probably the best; but for average conditions it will be found that a round stack gives the best results, being easier to build and showing very little waste when finished.

The best time to cut has already been dealt with, but it may again be stated that the material should go in at its best, and while it retains sufficient sap to bring about the necessary fermentation or cooking. Occasional showers during the building of the stack are generally an advantage, and necessary if the material has been allowed to become overripe.

Stacking Outfit.—The most useful outfit for the small farm is the mast stacker and grab, with one sweep. This outfit is conveniently worked by three men and a boy. If more labour is available two sweeps may be used, but then five or six men and a boy are required. There are various makes of mast outfits, but they all work on much the same principle. This outfit is equally useful for stacking hay. On larger farms, or where gangs of farmers are working together, stackers of the Deering type will be found more useful.

Building.—Having everything ready for a start, sufficient material should be cut and the stack built up to 8 ft. or 9 ft. the first day. Usually the material should be cut and put straight into the stack, with the exception of lucerne crops containing much very succulent material such as sow-thistles. In such cases the material may be allowed to wilt for a few hours before stacking. The stack, having been built up to 8 ft. or 9 ft., should be allowed to stand for one or more days until it has settled down properly, and until the temperature in the centre is between 120° and 130° F., the best ensilage being made between those points. The temperature having risen to the proper point, stacking may be continued from day to day, but if it is noticed that the stack is not settling or that the temperature is low it should be given another spell for a day or two. The general rule is: If the temperature is getting too high, add more material; if too low, refrain from adding material until it has reached the desired point. At one time it was thought that brown sweet ensilage was the best, but experience has shown that the green fruity kind has a greater feeding-value than the brown. If the stack temperature does not exceed 130° the superior green ensilage will result.

Experienced ensilage-makers can tell from the feel and appearance of the stack if the temperature is right, but beginners will find it a great help to use a thermometer. All that is necessary is a piece of $\frac{3}{4}$ in. or 1 in. piping, 4 ft. to 6 ft. long. Into one end of this a pointed stick is placed and the pipe driven into the stack. The thermometer is then attached to a piece of string and lowered down the pipe. An ordinary milk-thermometer is satisfactory. The thermometer may be pulled up from time to time as required to ascertain the temperature. When ready to start building again the pipe and thermometer are removed, and at the end of the days' work replaced in position.

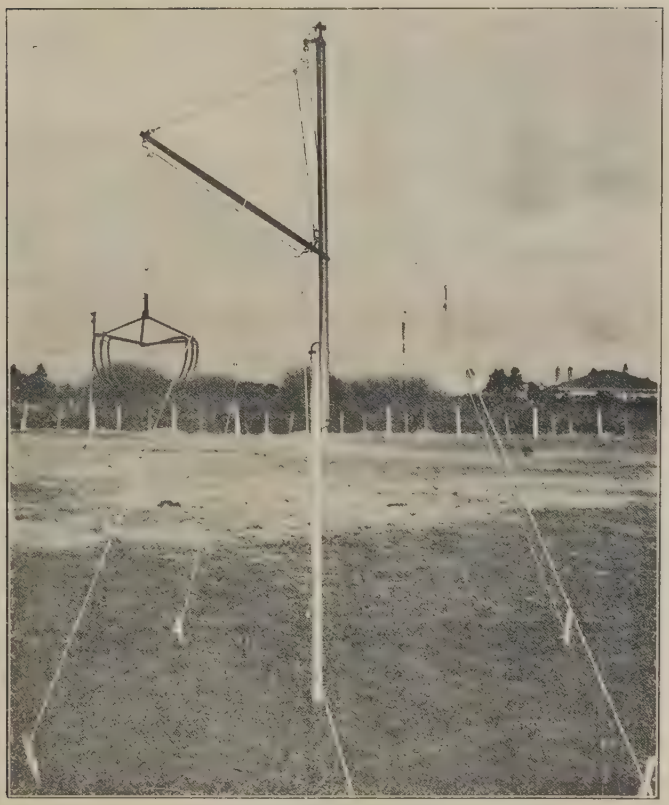


FIG. 5. MODEL MAST OUTFIT FOR STACKING ENSILAGE.

When building the stack great care should be taken that the outside walls and corners are kept firm by tramping. The centre should be kept full, but not hearted up like a haystack, the idea being to keep the surface as near level as possible, with the walls hard and firm to exclude air. On finishing the stack it should be hearted up, so that when earth is applied the centre will be a little higher than the wall. During the process of building the stack should be frequently pulled hard and the material thrown into the centre. If while the stack is being built the wind is constant from one quarter it will have a tendency to drive the heat to the lee side and cause uneven heating and settling, with the result that the stack sometimes topples over. To guard against this a sheet or some sort should be hung on the exposed side while the wind is blowing.

Weighting.—When the building of the stack is finished it must be weighted to cause even settling and control of temperature. In most places earth is the most suitable material for this purpose. If the stack is hot and settling quickly the earth should be put on at once, but if the settling is slow it is best to wait a day or two, as by this time the height of the stack will be considerably reduced, and it will be seen if the settling is even. It is good practice to fix a frame of some sort round the stack to hold the earth. This frame should go as near the edge as possible. The nearer the pressure can be got to the edge the less will be the wastage of material. Sometimes a frame of sawn timber made of two 6 in. by 1 in. lengthways, supported by 3 in. by 1 in. stays, and braced lengthways and across with fencing-wire, is used; but the more common practice is to place poles along the sides and ends, tie across with wire, and put earth inside them. Another useful method is to run a wire round the stack about 2 ft. from the edge, tying it with cross-wires, then filling old manure-bags or benzine-tins with soil, and hanging these to the wire to serve as a frame.

Probably one of the best methods is to secure some 10 in. by 1 in. boards, cut them to suitable lengths, and join them together with hinges made of ordinary fencing-wire. For square stacks the timber should be cut in lengths to suit the size of the stack, but for round stacks the boards are cut to 3 ft. lengths. Another common method of holding the earth is to put some heavy sheep-netting round the stack, line it with sods or grass, and then fill in. Others, again, simply put the earth on and trust to luck in getting it as near the edge as possible, but in this way the loss around the stack is greater.

The soil should be put on to a depth of 9 in. to 10 in. along the sides, running to 15 in. to 18 in. in the centre. If the season is very dry it will pay to double the quantities of earth.

The stack should be watched for a week or two to see that it settles evenly, some of the earth being moved from place to place, or more added if found necessary.

The silage may be fed at any time, but it is better to let it stand a month or two. When ready to use it, only a small area of the stack should be opened at once, so that at least 6 in. of the whole area opened will be removed daily. Ensilage deteriorates rapidly when exposed to the air. In feeding, a start should be made with 2 lb. or 3 lb. per cow until the animals get used to it, gradually increasing up to 30 lb. or 40 lb., which should be the maximum per day for ordinary purposes. On the average a cubic foot of ensilage weighs about 45 lb.

USE OF SALT.

During the progress of making ensilage it is a good practice to add salt, as this improves the quality of the silage and is a good way of feeding salt to the stock. The poorer the material the more salt should be added. From 4 lb. to 6 lb. should be used per ton of green material. Stock feeding on silage to which salt has been added will require plenty of good water.

METHODS OF TRANSPORT AND UNLOADING.

Various means may be adopted to transport the green material to the stack, pit, trench, or silo, those generally used being the sweep,

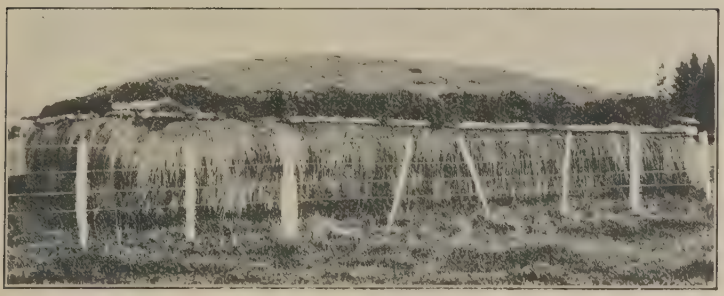


FIG. 6. WELL COVERED ENSILAGE STACK, WITH EARTH HELD IN POSITION BY POLES.

FIG. 7. STACK WITH EARTH HELD IN POSITION BY WIRE NETTING.

FIG. 8. MANURE-BAGS USED TO HOLD EARTH IN POSITION.

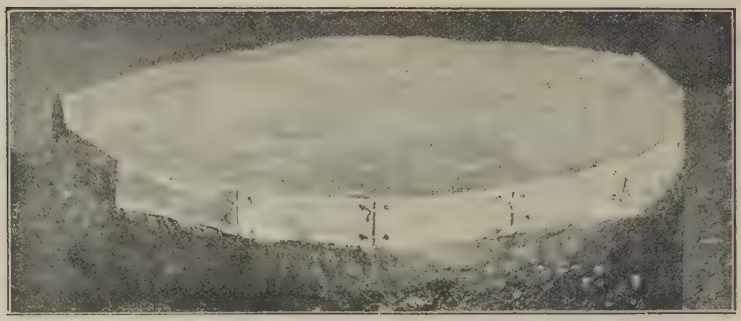


FIG. 9. MODEL SHOWING METHOD OF TYING BOARDS WITH FENCING-WIRE FOR HOLDING EARTH ON STACK.

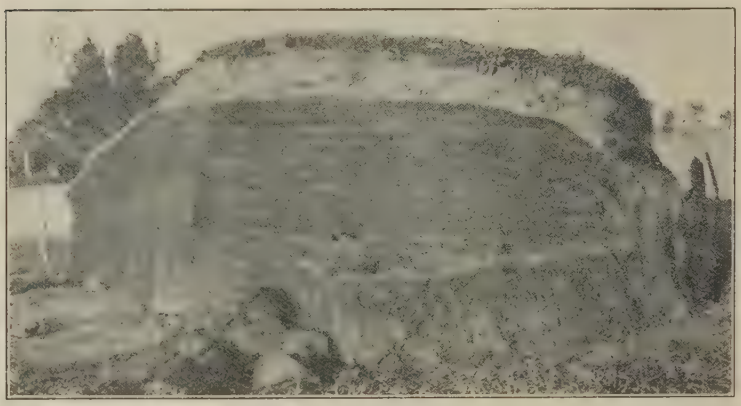


FIG. 10. STACK WITH CENTRE WELL COVERED, BUT WEAK ON OUTSIDE EDGES.

FIG. 11. EXAMPLE OF STACK MADE WITH TOO LARGE A BASE FOR QUANTITY OF MATERIAL.

the sledge, and the dray. For general purposes the sweep is easily the best; next to this an easy-running sledge; and then the dray. If the dray has a tip so much the better, as this greatly facilitates unloading, particularly when driving over a trench. If the ordinary dray is used it is advisable to use a rope to assist in the unloading. This rope is placed on the bottom of the dray, with the two ends fastened at the back and the loops hanging loosely in front. When the material is brought to the place of unloading another rope is thrown over the load from behind and hooked on the loop of the rope already on the dray. The loose end of the second rope is then half-hitched round a post and the dray driven forward, depositing the load where required, the actual place of deposit being decided by the length of loose rope left between the dray and the posts. The same method may be used for unloading a sledge. Another good way of unloading a sledge is to put in two posts, one against the stack or pit, and one a sufficient distance out to allow the sledge to be driven between the two posts. A rope is fastened to one of these posts, then when the loaded sledge is in position the rope is brought round the front of the load about 2 ft. above the sledge and the sledge driven forward.

WHY FARMERS SHOULD MAKE ENSILAGE.

(1) Weather does not to any extent interfere with ensilage-making, consequently grass or special crops may be cut just when they are at the right stage of growth.

(2) The making of ensilage is one of the greatest helps in grassland management, and, by providing a sure and economic means for the removal of surplus grass, it enables the farmer to keep his pastures in a fresh green condition.

(3) By proper management and a full use of ensilage it is possible to economically utilize the surplus grass during the flush period and thus get a high return from the money spent on fertilizers. Economic butterfat-production per acre is far more important than the average butterfat-production per cow.

(4) By providing good succulent fodder in the non-growing periods, ensilage enables the farmer to keep his stock in good condition and carry a sufficient number to enable him to make a highly profitable use of the greater proportion of his grass during the flush season.

(5) For feeding during dry spells in summer, and for autumn, winter, and spring, silage is excellent. The yield from silage-fed cows is equal to that of cows fed on the average green crops.

(6) Coarse grasses and plants, which have very little feeding-value when made into hay, make very useful silage.

(7) Silage may be used as soon as it is saved, or, if properly made, it may be kept for a number of years.

(8) Cows fed on silage and hay come into profit in better condition than cows fed on hay and roots or hay alone.

(9) Silage can be made from most fodders that are grown for stock.

(10) A good supply of ensilage is the best insurance policy a farmer can carry. It provides a high-class succulent fodder for any period of the year.

MOULDS IN UNSALTED BUTTER.

RESEARCH AT WALLACEVILLE LABORATORY.

G. F. V. MORGAN, N.D.A., N.D.D., Dairy Division, Wallaceville Laboratory.

(Concluded.)

CLADOSPORIUM HERBARUM AND CLADOSPORIUM BUTYRI.

These two moulds will be considered together so far as their effect on dairy-produce is concerned, as they are similar in most respects, there being only a slight difference in their cultural characteristics.

The *Cladosporia* are a common cause of discoloration in unsalted butter, and produce large olive-green to brown patches in butter in which they may be growing. Both moulds cause the same discoloration. Contamination of unsalted butter with this type of mould is far more prevalent in the butter-room than in any other part of the factory. The spores have never been isolated from butter-box wood or butter-parchment during the time that work on butter-moulds was being carried out. While it is possible that contamination of butters in this manner with these two types of mould may occur, it can be safely said that this is not common. When petri dishes were exposed overnight to factory atmosphere beside the vats in which the cream remains for churning on the following morning, colonies of the two *Cladosporia* were far the most numerous type of mould found present. Spores of this mould have been isolated from factory water-supplies.

Mycelial Growth and Spore-formation.—Staining methods have not been found satisfactory for examining the structure of the heads of this type of mould. The structure of the head seems to be more delicate than that of the other types, and when the mould comes into contact with liquid or glycerine, or when the head is removed from the colony on which it is growing, however carefully this is done, the branching portion of the head becomes detached and no trace of the branching structure remains. The heads of the *Cladosporia* usually tend to a very dense development. The conidiophores of *Cladosporium herbarum* are dense, bushy, a deep olive in colour, and compact in growth. In this respect they differ from those of *Cladosporium butyri*, which develop a dense olive growth in the centre of a colony, but show a somewhat straggling white growth on the outside and top, forming a white ring. The white ring seems typical of the growth of this mould on artificial media. In dairy-produce and on butter the loose surface growths of straggling white heads are characteristic, though it is impossible to differentiate between them with the naked eye if an aerial mycelium is not formed. The discoloration caused by these moulds is the same in both cases. The formation of the branched head of the *Cladosporia* occurs at the end of a fairly short aerial growth. Branching commences with short hyphal cells constricted at both ends and giving rise to further short constricted cells. At the connection of these cells branching occurs by the budding-out of further cells of the same type, which again bud out further very short cells that are oval and yeast-shaped and form the majority of the spores by which the mould is propagated.

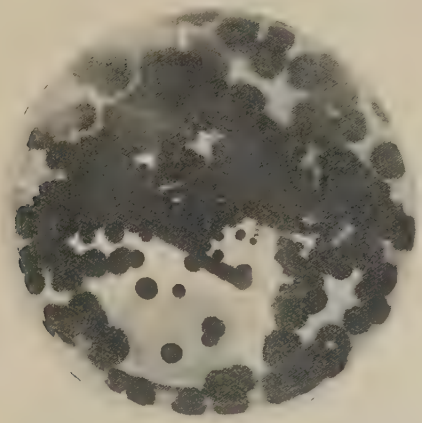


FIG. 12. CULTURE OF CLADOSPORIUM HERBARUM ON ARTIFICIAL MEDIUM.

FIG. 13. PHOTOMICROGRAPH OF CONIDIOPHORE AND CONIDIA OF CLADOSPORIUM HERBARUM ($\frac{1}{6}$ LENS).

[Photos by G. F. V. Morgan.

Thermal Death-point.—Germination has been obtained by spores that have been subjected to a temperature of 60° C., but not higher than 70° C.

Resistance to Brine Solutions.—*Cladosporium herbarum* will germinate and grow in a medium containing 7 per cent. of salt. Germination has been obtained from spores of *Cladosporium butyri* in media containing 8 per cent. of salt. *C. butyri* seems to be slightly more resistant to salt than *C. herbarum.*

Resistance to Disinfectants.—Spores will germinate after remaining in 5 per cent. formalin for ten minutes. They are also capable of germination after remaining in water for three months.

Biochemical Reactions.—Moulds of the *Cladosporium* species are capable of very rapid breakdown of protein second only to *Oidium lactis*, with the production of gas and an alkalinity of the medium.

Anaerobic Growth.—No development was obtained from young spores of *Cladosporia* in one week under strictly anaerobic conditions when incubated at 20° C.

Behaviour under Cold-storage Conditions.—*Cladosporia* are capable of germination after remaining under cold-storage conditions for three months at 5° C. in not less than three weeks after the butter has been defrosted.

General Observations on Butter-moulds.

Biological factors causing the deterioration of unsalted butters belong to three type—bacteria (fission fungi), yeasts (imperfect fungi), and moulds (fungi proper). These three groups form a continual source of deterioration from the time the butter is made to the time it leaves cold storage.

Bacteria come first in this process, their maximum activity occurring in the cream before churning and in the butter directly after manufacture. From the first twenty-four hours after manufacture their numbers decrease, till in six weeks only one-third of the original count remains, a large number of which are spore-forming organisms. Butter held under cold-storage conditions decreases in bacterial count much sooner than that held at room-temperature. Yeasts are plentiful in all unsalted butters, and their activity may be noticed from the time of manufacture to the time the butter is consumed. Mould-spores enter the butter during manufacture, and remain dormant for some time before germination takes place. In this way germination of mould-spores rarely takes place before the butter is placed in cold storage, and it passes out of the country as mould-free. The spores will not germinate in cold storage, but are capable of slow germination after defrosting on removal from cold storage. By this time, in the case of New Zealand unsalted butter, a large proportion of the bacteria will have disappeared, but mould-spores and yeasts remain in abundance and carry on the process of deterioration.

In recent years a considerable amount of experimental work has been carried out on moulds in unsalted butter, and a number of short articles and papers have appeared on this subject. Mould-counts in particular have recently been adopted by wholesale firms buying unsalted butter. These counts should be a great guide to the quality of the butter purchased. Certain well-known workers in dairy science in different parts of the world have been inclined recently to throw discredit on the mould-count as an indication of quality, owing to very varied results being obtained.

Experiments carried out very carefully and under standard conditions in New Zealand have shown that the mould-count, if properly conducted, is of considerable value. Variations in mould-counts may occur from several factors. The most important is insufficiency of time allowed for germination after defrosting. Work at Wallaceville has demonstrated that there is often a considerable difference in the time required for germination of mould-spores of the same species. There is also a very considerable difference between the time required for the spores of

various genera of moulds to germinate if they have remained under cold-storage conditions for any length of time. Experiments carried out in the cold stores at Wellington have, over a number of tests, shown that in this respect butter-moulds may be divided into two classes—those that germinate fairly soon after defrosting, and those that germinate only a considerable time after defrosting. Members of the first group are *Penicillium glaucum*, *Oidium lactis*, and *Stemphylium*, germinating in from four days to two weeks. The second group consists of *Fusarium lactis*, *Cladosporium herbarum*, and *Cladosporium butyri*, germinating in not less than one month after defrosting, having remained at an average temperature of 55° C. for three months.

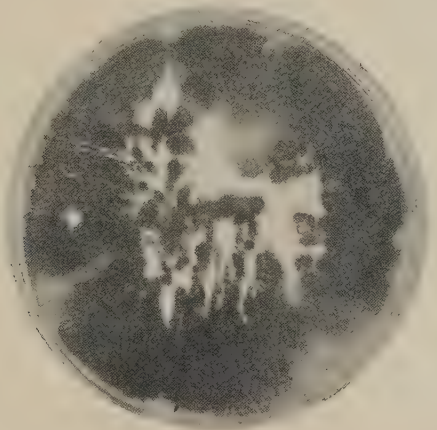


FIG. 14. CULTURE OF STEMPHYLIUM ON ARTIFICIAL MEDIUM.
Photo by G. F. V. Morgan.

This brings forward an important point in connection with the taking and culturing of butter-samples for mould-counts. Cultures for mould from butter-samples that have been in cold store for any length of time should never be thrown away till at least one month has elapsed from the time the butter examined was defrosted, as the spores of the mould that will not germinate in less than one month after defrosting will not germinate any sooner when they are transferred to a fresh medium. To this end care should be taken that the loss of moisture from the medium in the petri dish or test tube in which the culture is made is not too great. Unless precautions are taken solid media will, in less than a month, become too dry to be suitable for mould development.

Another important factor in obtaining consistent results with mould-counts is the use of suitable media. After a trial of a number of media at the Wallaceville Laboratory, Czapeks solution agar was found to be the most reliable medium for the growth of *Penicillia*, *Fusaria*, and *Stemphylia*. Malt agar was found most suitable for the growth of

the *Cladosporia* and *Oidium lactis*. In plating out butter-samples for moulds it was found most satisfactory to take the lowest dilution—namely, 1/10—and with a 1 c.c. pipette with a fine-point drop, culture 1 c.c. of the dilution over the surface of the medium to be used in a large petri dish. On no account should shake cultures of dilutions for mould-growth be used. If these points are observed in the examination of butters for moulds consistent results will be obtained, and little decrease in mould-counts will be found during the time the sample remains in cold storage.

COMPARISON OF MOULD AND BACTERIAL ACTIVITY IN BUTTER.

Bacteria.	*Moulds.*
(1) Bacteria destroyed by pasteurization	Mould-spores destroyed by pasteurization.
(2) Contamination in the factory general	Contamination mainly through cream remaining exposed in factory atmosphere in freezing-vats, contaminated water-supplies, and parchment.
(3) Bacterial count per gramme frequently over 1,000,000	Mould-counts per gramme rarely over 300.
(4) Bacteria decrease steadily, whether the butter is placed in cold store or remains at atmospheric temperature	Mould-spores germinate in less than two weeks in unsalted butter kept at room-temperature, causing discoloration. Spores remain virile in cold store and do not decrease in number.
(5) Bacteria vary considerably, decrease in number after three months at cold-storage temperature; majority remaining are spore-formers	Mould-spores not decreased in number; speed of germination retarded.
(6) Bacteria susceptible to their own toxic products, which limits their development	Moulds can continue growth till all available food-supplies are consumed and the medium covered.
(7) Bacterial activity limited by the acidity or alkalinity of the medium in which it is growing	Moulds grow equally well in acid or alkaline media. (Extensive cultures over a varied pH range were made for all moulds.)
(8) Bacterial action may continue for a considerable time unnoticed	Presence of mould immediate—visible on germination.

Precautions against Mould Contamination.

Precautions should be taken against mould contamination in butter-factories. One of the first and most important steps is to see that the factory is thoroughly well ventilated, and that the steam rising from the pasteurizers can be removed from the butter-room as soon as possible. Covered coolers are strongly to be recommended. All butter-parchment should be kept dry and covered. Butter-boxes should also be kept dry and covered by their lids, instead of allowing the lids to remain inside.

Chilled water-tanks should always be covered, preferably with metal, if the water is to be used for washing butter. (It is most desirable to pasteurize washing-water, as it frequently becomes contaminated at its source with mould-spores and bacteria.) Only butter-parchment of the best quality should be used; trouble with moulds nearly always arises when butter-parchment of poor quality is used. Mould-counts taken from cheap butter-parchment at the Wallaceville Laboratory have in some cases been very high, and in some cases virile mould-spores (*Penicillia*) have been isolated from the

body of the parchment itself, showing that contamination of parchment may occur in careless manufacture. When moulds have obtained a firm footing in a butter-factory remedial methods should be adopted, though most of the methods at present practised are only very temporary in their effects. Strong limewash and formalin are more effective together than used separately. Such disinfection should be carried out at least once a month.

The fact that most moulds will germinate in a medium containing 6 or 7 per cent. of salt draws attention to the true salt percentage of salted butter from the biological point of view. New Zealand salted butter generally contains 1½ to 2 per cent. of salt; this salt percentage is worked out on the whole bulk of the butter, including fat. The salt, however, after it is worked into the butter is not absorbed by the fat, but remains in solution in the butter-water (about 16 per cent.) surrounding the fat globules. Therefore the true salt percentage considered from the biologic point of view should be worked out on the total salt percentage in the percentage of water present, and not in the total bulk of the butter.

Spores of *Penicillia* and *Oidia* are frequently found in samples of unsalted butter after subculturing in artificial media, but development of mould in salted butter itself is rarely seen. These mould-spores have remained virile in salted butter for perhaps three months at cold-storage temperature, but have been unable to germinate in the butter-moisture of high salt content. They have, however, been able to germinate again when removed to a non-saline artificial medium. When mould investigation work is undertaken control cultures should always be carried out in sterile butter.

Contamination of butter-parchments during their manufacture occurs through the washing of the pulp after treatment with sulphuric acid by contaminated waters, which introduce mould-spores into the substance of the paper before manufacture is complete.

THE OFFICIAL HERD-TEST.

THE second year's results of the official herd-test have borne out the expectation of increased support expressed in the review of the first season's work, which appeared in the *Journal* for September, 1928. The number of registered purebred cows on official herd-test at the height of last season was 1,666, as compared with some 1,550 in the flush of 1927–28.

The records for the first year were summarized to 31st July, 1928, but later experience has taught us that this closing-date was too early, and likely to occasion too large an overlap from season to season. While the great majority of O.H.T. entries up to the present have been for cows calving in early springtime, a number of entries are made for cows calving later in the year, and it is difficult to know where to draw the line for annual summarizing purposes. At present it would seem that 30th October will be the most suitable closing-date, and this assumption will be worked on for the present year at least. It is therefore expected that our second annual review of the O.H.T. system will appear in the *Journal* for November next.

—*Dairy Division.*

PUWERA GUM-LAND EXPERIMENTAL FARM.

PASTURE ESTABLISHMENT AND CARRYING-CAPACITY.

P. W. SMALLFIELD, M.Agr.Sc., Fields Superintendent, Auckland.

THE gum-land clay areas of North Auckland consist of undulating, treeless downs rising occasionally into low hills. The surface soil is generally a clay which varies in texture from a strong white pipeclay to a yellow rubbly clay. The white pipeclays carry a low growth of manuka scrub, bracken-fern, and rushes, while on the yellow rubbly clays bracken-fern is often the dominant covering. The surface soil, being deficient in humus, is very sticky in the winter and bakes very hard during the dry summer weather. Cultivation is accordingly difficult and costly, as the land can only be satisfactorily ploughed and worked in the autumn and early winter, and again in the late spring and early summer.

In addition to the low natural fertility of the soil the grassing of the gum-land areas has been rendered still more difficult by the operations of gum-diggers. The ground was roughly dug up whenever gum was suspected to exist, and a thin layer of top soil, generally only a couple of inches thick, was buried a foot or more down; and deep holes were dug and left unfilled. But what led to the worst destruction of the soil was the continued burning-off of the covering scrub. The gum-digger did not cut down and clear away the vegetation on the surface of the ground he wished to clear; he resorted to the simple method of "putting a match into it." Fires started to clear a few yards often swept hundreds and thousands of acres. This repeated burning-off caused every vestige of dark surface soil to disappear and left a bare pipeclay surface soil on extensive areas of gum-land.

Although the gum-land in its natural state looks very unpromising, the grassing experiments conducted at Puwera Farm have shown that quite good pastures composed of rye-grass, paspalum, and white clover can be established and maintained on these poor clay soils. The experimental work conducted on the farm has been reported on from time to time in the *Journal* since 1921, and the purpose of this article is to briefly summarize the grassing operations carried out, and to bring the information up to date from the publication of the last report in 1927.

METHODS OF GRASSING GUM-LAND.

The surface covering of the land is first cut and burnt, and the holes left by the gum-diggers filled in. The amount of work involved in filling in holes varies considerably on different areas, in some places there is practically none of this work to be done, while in other places it may cost up to £2 per acre to prepare the land for ploughing. On other areas, where only the surface of the land has been worked by the gum-digger's spade, the uneven surface, covered by huge clods, has often to be partially cleared and levelled by hand before it can be satisfactorily ploughed.

The varied condition of the surface has led to several different methods being adopted for breaking-in the land. The chief among these are briefly as follows:—

(1) Surface cultivation with disks and harrows, followed by the sowing of a comparatively light grass mixture. Lotus hispidus is an important constituent of the primary sowings; it establishes quickly on the poor clay soils, and greatly improves the quality of the land on which it is growing. The temporary pasture is left down from two to four years, and the land ploughed and sown down to permanent grass.

(2) The land is ploughed and left fallow for six to twelve months, then worked up and sown in permanent grass. Sometimes an annual crop is taken before the land is sown to grass.

(3) The land is ploughed, fallowed six to twelve months, reploughed and subsoiled, limed, and sown to permanent grass. Again an annual crop may be taken before the land is sown in grass.

At Puwera the early pastures were sown down after the thorough preparation of the land as outlined in (3) above, while the later sowings were made after only one ploughing and a short fallow. New pastures on gum-land have usually only a low carrying-capacity, and it takes several years of regular top-dressing with phosphates and careful stocking before a good sward of grass is obtained. The older pastures at Puwera are now quite good dairying grassland, whereas the newer ones still contain a fair proportion of bare ground, and it will take a year or two of careful management before they are brought up to the level of the old pastures.

CARRYING-CAPACITY OF THE PASTURES AT PUWERA FARM.

During last season a careful record was kept of the stock-grazing days for each field on the farm, and the carrying-capacity of all the improved fields from September, 1928, to June, 1929, is given in the following table:—

Present Field Number.	Old Field Number.	Area.	Milking-cow Days per Acre.	Dry-stock Days per Acre.	Type of Pasture.
		Acres.			
1*	1	3	63	28	Rye, cocksfoot, kikuyu, and white clover.
2†	2	7	97	42	Rye, paspalum, kikuyu, and white clover.
3	3A	2½	331	57	Rye and white clover.
4	3A	2½	362	115	Rye and white clover.
5	3B	4	..	..	(Dairy-shed paddock.)
6	3B	2½	291	70	Rye and white clover.
7	3B	2½	345	74	Rye and white clover.
8	4	8	91	31	Kikuyu and brown-top.
9	5	12	289	32	Rye, paspalum, subterranean and white clovers.
10‡	6	8	124	34	Paspalum, rye, and white clover.
11‡	6	2½	24	..	Paspalum, rye, and white clover.
13	..	12	..	..	(New grass.)
14	7	3	208	68	Rye and white clover.
21*	..	8	..	56	Rye, white clover, and Lotus hispidus.
22	..	13	..	100	Rye, brown-top, paspalum, and white clover.
23	..	20	..	44	Rye, white and subterranean clover, and bare ground.

* Cut for hay. † Rank growth mown for hay. ‡ Cut for ensilage.

MILKING-COWS GRAZING FIELD 4 AT PUWERA FARM IN AUGUST, 1929.

The field was dressed with 1 cwt. sulphate of ammonia on 8th July, and gave fourteen cow-grazing days per acre from 8th to 10th August. Farm-buildings seen in middle distance.

Fields 1 and 2 are situated on fairly good flat land, and for a number of years were used for the production of annual crops and experimental grass sowings. Field 1 now contains three different pasture sowings—a section of old cocksfoot pasture which was sown down in 1917, a section in kikuyu-grass planted in 1920, and a rye-grass and white clover pasture sown in 1926. Field 2 also contains sections sown in pasture at different times; part of the field was planted in kikuyu in 1922, part sown in paspalum in the same year, and the remainder sown in a rye-grass and white clover pasture in 1926. The kikuyu-grass in these fields has now become sod-bound and is not throwing a great deal of feed. Although this grass has probably a place in grassing poor bare patches on slips, it cannot be recommended at all for land capable of carrying a rye-grass - paspalum - white clover type of pasture.

Fields 3, 4, 5, 6, and 7 are situated on fairly good flat land, and the pastures consist of perennial rye-grass with a sprinkling of paspalum. The area now occupied by Fields 3 and 4 was first ploughed between 1920 and 1922, fallowed, drained, cropped with soft turnips, swedes, and green cereals, limed, and sown in grass in April, 1923. Fields 5, 6, and 7 were first ploughed in 1919, drained, limed, subsoiled, cropped with soft turnips, swedes, and rape, and sown in grass in the autumn of 1921. For a few years after sowing the pastures were of only medium productivity, but a good strain of perennial rye-grass was sown in the original mixture, and as the surface fertility was built up by regular phosphatic manuring the pastures improved wonderfully, and are now first-class dairying grassland.

Field 9 is situated on a steep pipeclay hill, and is an excellent example of the effect of regular phosphatic top-dressing in converting quite a poor strike of grass into a good dairying pasture. The field

was broken up in 1918, cropped with oats, again ploughed, limed, and sown in mustard. The mustard was ploughed in as a green manure, the land again limed, and sown in grass in the autumn of 1920. The field was laid out in eight plots, which were sown in various grass mixtures running from an Italian rye-grass and paspalum mixture to a perennial rye-grass, cocksfoot, dogstail, and paspalum mixture. As indicated, the original strike of grass was poor, but regular top-dressing has built up the surface fertility, and the pasture over the whole field now consists of perennial rye-grass, paspalum, and white and subterranean clovers. During the past season the field gave 289 cow-grazing days and 32 dry-stock days per acre, which is quite a high carrying-capacity for a field of this size.

Turning to the newer grass-sowings on the farm—Fields 21, 22, and 23—it will be seen on referring to the table giving the grazing-days for each field on the farm that they have produced very little feed during the past season. These fields, however, now possess quite as good a turf as that of Field 9 for the first few years after it was sown, and it is reasonable to suppose that regular top-dressing and careful stocking will ultimately bring them up to as high a carrying-capacity as the older fields. Fields 22 and 23 consist of steep clay ridges, and were grassed down in 1926 and 1927.

Field 22 was first ploughed in the spring of 1925; the land then lay fallow till the spring of 1926, when it was disked up and sown in grass in September. The following grass mixture was used: Italian rye-grass, 4 lb.; perennial rye-grass, 10 lb.; crested dogstail, 3 lb.; paspalum, 12 lb.; brown-top, ½ lb.; red clover, 3 lb.; white clover, 2 lb.; subterranean clover, ½ lb.: total, 35 lb. per acre. Before sowing to grass the land was dressed with 4 cwt. of basic slag, and 3 cwt. of super was sown with the grass mixture. The field was top-dressed in 1927 with 3 cwt. of basic super, and in 1928 and 1929 with 3 cwt. of basic slag. Up to a year ago the pasture on this field was very thin, but it is now thickening up, and paspalum is appearing in most parts. Next season the field should provide a good deal of grazing.

Field 23 was first ploughed in the spring of 1926; it lay fallow till the autumn of 1927, when it was disked up and sown down in grass in March. The following grass mixture was used: Italian rye-grass, 5 lb.; perennial rye-grass, 10 lb.; crested dogstail, 3 lb.; paspalum, 7 lb.; red clover, 3 lb.; white clover, 2 lb.; Lotus major, ½ lb.; and subterranean clover, ¼ lb.: total, 30¾ lb. per acre. Prior to sowing in grass, part of the field was divided into plots to test the value of heavy dressings of phosphates in promoting a quick establishment of grass. Two plots, each about 2 acres in area, were given 9 cwt. of basic slag, and two plots 9 cwt. of Seychelles guano; the remainder of the field was left as a check plot; 3 cwt. of superphosphate was sown with the grass mixture over the whole field. The plots that received the 9 cwt. of basic slag have always been the best parts of the field, and during the past two seasons have carried a good growth of red clover. The general pasture in the field is still open and poor, although it has thickened up appreciably during the past season. The field was top-dressed with 3 cwt. of basic slag in 1928 and 1929.

Gum-land clays can be made to carry good pastures, but the chief factor preventing the unoccupied areas being broken in for settlement is the length of time that elapses between the sowing-down of the grass

and the establishment of a good pasture. On most gum-land it takes three to five years, with regular top-dressing and careful stocking, to convert the thin, open turf on the newly turned clay into a good rye-grass, paspalum, and white-clover pasture. During the early part of this period the land gives very little good grazing, and the amount expended annually on manures for top-dressing and interest on the cost of putting the land in grass has to be met out of the settler's capital.

WATER-SUPPLY.

A large proportion of the gum-land clays are badly watered. During the winter, after the surface soil has become wet and sticky, practically the whole of the rain-water runs off the surface and very little soaks down into the deeper layers of the soil. Creeks with a strong winter flow go dry early in the summer. At Puwera Farm the water-supply is provided by dams cut in the hillsides, in which is collected water which runs off the surface of the fields in the winter and spring. The water is of poor quality, and the supply fails during dry weather. Bores have been put down at Puwera to a depth of 300 ft., but no adequate water-supply has been obtained from them, and a pumping scheme for a regular supply for the farm is now under consideration.

MISCELLANEOUS NOTES.

During the 1927–28 season the pastures and stock on the farm suffered from the abnormally dry summer weather. All the pastures burnt up badly, and the stock had to be carried for nearly three months on ensilage and hay. Thirty-six cows were milked during the season, and 7,139 lb. of butterfat was supplied to the factory. During the 1928–29 season the general calving of the herd was late, and although a total of forty cows were milked the butterfat production was only 7,369 lb. All late-calving cows and cows not got in calf last season are being milked through this winter, and by this means it is ultimately hoped to get the whole herd calving again in July–August.

Last season an ensilage-pit was dug out of the hillside in Field 10. The pit is fitted with a narrow boarded entrance, which prevents the green material, after the pit is filled, creeping towards the entrance and leaving a space between the earth walls and the ensilage. If an air-space forms in this way there is often a good deal of waste. The material used to fill the pit consisted of rye-grass, paspalum, and clovers, and made excellent silage. The waste on the sides and ends of the pit was negligible. The silage was fed to the milking-cows during the past winter.

During the past season Fields 3, 4, 6, and 7 were used for grazing experiments to test the value of nitrogenous fertilizers in producing increased grass-growth. These experiments are part of a large programme with nitrogenous fertilizers which is being conducted in all parts of the North Island. Field 4 received four 1 cwt. dressings of sulphate of ammonia, and Field 7 four 1 cwt. dressings of Nitro-chalk. From September to June Field 4 gave 31 cow-grazing days and 58 dry-stock days more than Field 3, and Field 7 gave 54 cow-grazing days and 4 dry-stock days more than Field 6. These experiments are being continued during the present season, and Field 9 has now been divided into four 4-acre fields, so that this experimental work may be extended.

CROWN-GRAFTING MATURED FRUIT-TREES.

THE INLAY METHOD.

M. DAVEY, Orchard Instructor, Wellington.

OWING to changing conditions in variety and market values, the commercial orchardist is in many cases confronted with the desirability or necessity of grafting—or reworking, as it is commonly termed—some of his matured fruit-trees. Many different methods are in practice with varying success; but if the results are closely followed the proportion of success is often seriously low. To cut down matured trees which are in bearing generally entails some sacrifice, and it is essential that a recovery of this loss, and a subsequent increase in profits, should be assured.

THE INLAY METHOD.

The method here described is termed "inlaying," and it has several features which may commend themselves to orchardists. The various operations are detailed below.

Cutting the stock: The process of cutting the stock consists in taking out an elongated V-shaped section of the hard wood, cambium layer, and bark, for a length of 3 in. or more, *not less*, the cut to taper towards the bottom, as shown in Fig. 1. The position of the operator and his method of holding the knife should be noted.

Cutting the scion: Here special care is needed, remembering that a good fit will be one of the deciding factors in successful grafting. Place the scion immediately against and over the incision in the stock, taking care that the lower end of the scion corresponds with the base of the cut. Also note the direction of the two top buds on the scion for future leaders, and adjust if necessary. Then firmly press the scion against the top edges of the cut in the stock. This will mark the bark of the scion and indicate the length and portion to be removed in trimming and shaping. This precaution obviates the cut surface of the scion extending above the crown of the stock. In trimming the scion take two sides off, as shown in Fig. 2, leaving the third side with bark attached. Now glide the scion into the cut in stock, and gently press it downwards until it will remain in position with the pressure exerted on the cut sides.

Nailing in the scion: This should be carefully done with two nails (Fig. 3), taking care not to displace the scion from its original position.

Waxing the graft: This last operation, which is of importance, should not be done casually, care being taken to completely and thoroughly cover up and seal all cut surfaces (Fig. 6) with wax at a boiling temperature, not forgetting to apply a portion to the end of the scion to prevent drying out. (*This last item is most important.*) The firebox shown in Fig. 4 is assembled with an inner water-container to prevent wax boiling over, and with wax-tin in centre, both of which are fastened together with fine wire to prevent spilling. The firebox should have a long wire handle, as without this it becomes too hot for carrying about.

FIG. 1. CUTTING THE STOCK.

Note position of operator and method of holding the knife, also stumps cut sloping in order to shed moisture.

FIG. 2. TRIMMING THE SCION.

Two sides are taken off, and one side left with bark attached.

RESULTS OF INLAYING.

The strong and vigorous growth shown in Fig. 5 indicates the results which may be expected if the work is well executed, and the style of pruning which should be adopted at the end of the season's growth. The results of inlaying on the lines described may be summarized as follows:—

(1) A maximum contact of bark and cambium on scion and stock is effected.

(2) Innumerable sap-bundles in the stock have been severed ready to discharge where corresponding sap-bundles in the scion are ready to absorb the life-giving juices of the tree.

FIG. 3. NAILING IN THE SCION.
Two ½ in. steel tingles are recommended for this purpose.

(3) No possible movement which may break the intimate contact of these parts can take place, owing to the uniform high pressure exerted by the nails, which also obviates any danger of grafts blowing out.

(4) No intrusion of free moisture or evaporation of sap can take place, owing to a perfectly hermetically sealed joint having been made by the thorough and careful application of the hot wax.

(5) The boiling wax has additional advantages in that it sterilizes the cuts and seals up the wounds, thereby preventing infection from silver-leaf and other fungus and bacterial diseases.

SELECTION OF SCIONS.

This feature should receive due consideration. In choosing wood for grafting always select vigorous one-year shoots with well-developed

leaf-buds. The strongest leaf-buds are generally situated in the centre of the annual growth. On no account use buds which may be converted into blossom buds, owing either to abnormal vigour or weakness on the part of the tree from which they are obtained. A bloom and two weak shoots will eventuate if this class of bud is used. The only course to pursue in such a case is to pinch out the blossom and one shoot, when only fair growth can be expected. The true and normal leaf-bud is flat and of triangular shape, lying close to the shoot. The best time to cut scions is about a month before spring growth commences.

FIG. 4. APPARATUS FOR USE IN WAXING THE GRAFTS.

Showing fire-box, inner water-container, and wax-tin.

During the growing season following grafting any shoots springing from the stock should be suppressed, not by being entirely removed, but by pinching out the terminals. The reason for this is that the roots need stimulating or excitement until the grafts take up the running, otherwise the terminals of the roots die back. If the shoots from the stock are not checked in any way, the grafts become submerged and stifled by what is only waste energy.

CARE OF SCIONS.

This is another important feature which is often treated too carelessly. Do not be content to stick the scion half-way in the ground. This often means that when the scion is required for use it is as forward as the stock, and the leaves which are pushing from the ends

FIG. 5. STRONG AND VIGOROUS GROWTH OF WELL-EXECUTED INLAY GRAFTS.

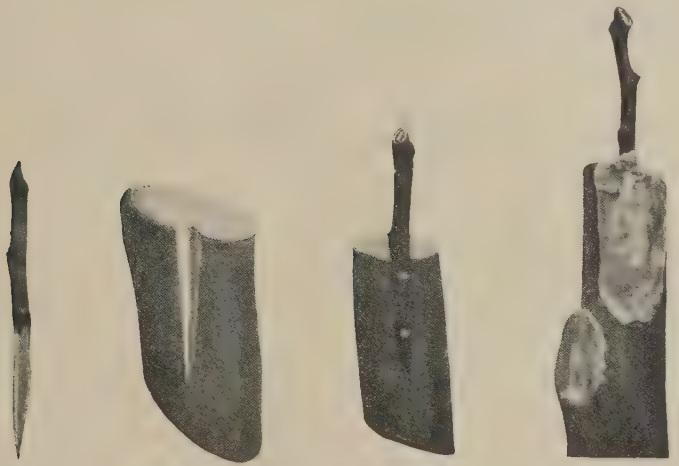


FIG. 6. FOUR STAGES OF INLAY GRAFTING.

(1) Scion cut; (2) stock cut; (3) scion nailed in; (4) all cut surfaces waxed (including those of any limbs removed to facilitate grafting operations, as here shown below graft).

of the shoots have exhausted most of the vitality from the very portion of the twig used for grafts. In the place of this rough and unsound practice scions of the variety to be used are best left on the tree until August, and then placed in damp sand in a cool shed. Or as an alternative, dig an oblong hole 2 ft. deep in a cool, *well drained spot*, and bury the scions completely. The result of this will be that, when the scions are dug out, fresh, plump, and perfectly dormant wood with all its reserves unimpaired is available. After grafting, replace the surplus wood into storage, and if any failures occur through lack of skill or accident one still has reserves of dormant wood to fall back on and can renew failures.

VARIOUS NOTES.

The most common formula used in European nurseries for grafting-wax—namely, four parts resin, two parts beeswax, and one part mutton fat or tallow—gives excellent results. In addition, assuming the quantities specified to be pounds, an eggcupful of raw linseed-oil will increase elasticity and prevent cracking, especially in the colder districts. Generally the wax adheres until pushed out of place by scion or tree.

The firebox is made from a benzine-tin by perforating the sides and bottom to create draught. Cut an opening in one side for replenishing fuel. Pass two short lengths of fencing-wire through the sides midway to act as a rest for the inner tin containing water, which should have solder floated in the seams to prevent leakage.

The nails recommended are ½ in. steel tingles, which can be purchased from most boot-repairing shops. These remain in the tree, and are grown over during the first season.

WORLD POULTRY CONGRESS, 1930.

THE Fourth World Poultry Congress will be held at the Crystal Palace, London, from 22nd to 30th July, 1930. The Congress is being organized by the British Government, and will be under the patronage of the King, the Queen, and the Prince of Wales. All persons interested in any aspect of poultry husbandry in any part of the world are invited to be present.

In connection with the Congress an Exhibition will be organized, comprising (1) national exhibits staged by participating countries; (2) exhibits of poultry, rabbits, and pigeons entered by breeders from all parts of the world; (3) commercial exhibits of interest to the poultry industry.

Information regarding entry fees for exhibitors and membership charges for delegates, together with plans and all other particulars concerning the Congress, may be obtained on application to the Secretary, World Poultry Congress, 10 Whitehall Place, London S.W. 1.

Importation of Stud Stock from Abroad.—Outbreaks of foot-and-mouth disease in Britain having persisted, the embargo on cattle, sheep, and swine from Great Britain is still in force. The only countries from which cattle may be imported into New Zealand at present are Tasmania, Canada, and the United States (with the exception of the State of California); swine may also be introduced from the same countries. The following animals from abroad entered into quarantine during the official year 1928–29 to undergo the required period of detention: Horses, 11; cattle, 29; swine, 33; dogs, 59.

FRUIT VARIETIES FOR NORTH AUCKLAND CONDITIONS.

RESULTS AT TANEKAHA TEST AREA.

W. H. RICE, Orchard Instructor, Auckland.

FOR the purpose of testing the suitability of soil and district for different varieties of pip- and stone-fruit a co-operative seven-year trial was arranged in 1922 between the Department of Agriculture and Mr. F. G. Long, of Tanekaha. This place is situated some five miles from Hikurangi, north of Whangarei, while the selected site which was planted in trees is typical of large areas of land in the locality and in the immediate north through the Jordan Valley. The soil is clay, requires drainage, and with green crops and continued cultivation becomes of good texture, though inclined to be wet in winter, mainly through the compact limestone subsoil and under-strata.

For shelter insignis pine was selected, a single line of two-year-old trees being set out 4 ft. apart. At the end of seven years they have grown into trees 40 ft. high and 10 in. diameter of trunk 1 ft. above ground. They are at present dense to the ground, but the growth indicates that the trees should be topped if lower growth is to be retained. The character of this shelter in relation to the fruit-trees shows that, while it is very suitable for the purpose, a greater distance than 20 ft. should be left for a headland.

During the period of the test all trees, according to variety, received precautionary sprays, and no pest or disease became established. Damage to trees or loss of crop attributable to pest or disease was negligible. Orthodox cultivation and green manuring was resorted to to keep the land in good condition. A normal manurial programme with fertilizers was carried out, no special attention being given to individual tree requirements, as it was considered that suitability of variety to soil and location could best be determined under nearly normal conditions.

Apples.

There are two types of tree on the area—varieties planted in 1922 and varieties grafted in 1925 on to stocks which had been planted in the permanent quarters in 1922. All apples are on Northern Spy root-stock. The following observations are recorded from a recent inspection of the trees :—

Albany Beauty.—Remarkably vigorous trees of exceptionally heavy build, good furnishings, and very fruitful. Could confidently be planted in the locality.

Alfriston.—Medium growth, only sparsely furnished. So far of shy cropping habit. Not to be recommended.

Ballarat.—Well suited to land and locality. Not large trees, but highly fruitful and desirable.

Becroft.—Grafted in 1925. Very heavy growth, but poor furnishings. No fruit yet.

Brighton.—Sturdy, heavy frame ; inclined to be bushy in habit ; liberally furnished with laterals ; very fruitful. Good in every way.

Celo.—Grafted in 1925. Have made excellent trees, and promise well for fruiting. To be recommended.

Cox's Orange Pippin.—Well suited, and excellent in every way.

Delicious.—Have made nice trees, not particularly robust but easy to train. Somewhat shy in bearing. Not as well suited to this locality as to many.

Dougherty.—Well suited; good in every way.

Dunn's.—Well-grown trees of sturdy character, but shy in fruiting.

Giant Jenneton.—Well suited to the locality and soil; nice tree, and fruitful. To be recommended.

Glengyle Red.—Grafted in 1925. Fair only; poor growth of a weak nature. Not well suited.

Golden Delicious.—Grafts from 1926. Doing well, and of great promise.

Gravenstein.—Well suited; among best trees on the area. Desirable in every way.

Grannie Smith.—Quite adaptable to the locality. Inclined to slender growth, and sparsely furnished with laterals, but nevertheless fruitful on main growth and spurs.

Jonathan.—Poor growth and very slender habit in this location. Fruitful and highly coloured, but not robust enough to justify planting.

King David.—Heavy growth and robust tree. Very fruitful and desirable; high degree of colour.

McIntosh Red.—Grafted in 1925; making good growth. Appears to be well suited, though not fruiting yet.

Parlin's Beauty.—Tree well suited to locality. Strong robust growth, though somewhat shy in settled fruiting-habit.

Premier.—Poor growth of tree; not suited in any way.

Ranelagh.—Grafted in 1925. Very poor trees; sparse growth, long-jointed in leaders, and not furnished. Does not promise at all well.

Salome.—Good growth; very robust tree, well furnished, and very fruitful. Suitable to locality.

Scarlet Pearmain.—Tree of indifferent growth. Very fruitful, though not to be recommended, as indications are that the tree stagnates after carrying a few crops.

Senator.—Very strong wood-growth, both in stability and height. Very shy in fruiting, and soft in what few fruits are produced.

Shoreland Queen.—Grafted in 1925. Very poor; nothing to recommend planting.

Shepherd's Perfection.—Grafted in 1925. Good growth of very light stability; no crop yet. Does not appear well suited.

Simmonds Winter.—Good robust tree; shy bearer; fruit of poor quality.

Stayman's Winesap.—Trees of great stature and stability, well furnished, and highly fruitful. Well suited to the district.

Statesman.—Medium trees; very upright growth, sparsely furnished; not well suited.

Sturmer.—Very poor growth; fruitful, but not suited to the district.

Tasma.—This variety is not well suited; poor in growth, and in no way desirable.

Washington.—Well suited to the locality; good in every way.

White Winter Pearmain.—Grafted in 1925. Very poor growth of extra-stout wood; very heavy crop. Variety does not appear well suited to locality.

Willie Sharp.—Good growth, but thin in character; fruitful but not exceptionally robust.

Worcester Pearmain.—Poor growth; in no way desirable.

Pears.

All the four varieties of pears under trial were slow in establishing, making very little growth for the first two seasons. Observations are as follows :—

Doyenne du Comice.—Not well suited ; poor trees in every way.

P. Barry.—Trees have grown well ; fair crop ; well suited in every way. To be recommended.

Winter Nelis.—Does not thrive under the local conditions ; poor trees in every way.

Williams Bon Chretien.—Good growth ; strong well-furnished tree ; so far shy in fruiting-habit. To be recommended.

Plums.

In a general way the land and locality are well suited for plum-culture, and indications are that plums could be well and profitably grown. The performance of those varieties under test has been as under :—

Ballena.—Tree not well suited to locality ; nothing to recommend it.

Doris.—Exceptionally strong growth ; well-furnished tree. Good quality of fruit, but medium crops only. To be recommended.

Greengage.—Very poor indeed ; not to be recommended.

Giant Prune.—Very poor growth ; does not thrive under the local conditions.

Hermosillac.—Trees did not thrive, and after several years were removed.

Hungarian.—Trees of reasonably good habit and growth ; no fruit so far.

Maynard.—Trees of fair growth only, and very shy in fruiting-habit. Nothing to recommend the variety.

Ngata.—Sturdy tree of good habit and remarkably heavy crop. To be recommended.

Purple King.—Planted in 1926. Tree well suited in every way ; not yet in fruit, but good promise.

Reine Claude de Bavey. Variety well suited to locality in tree-growth, but very shy in fruiting-habit.

Satsuma. Variety quite well suited to locality ; tree of good growth and satisfactory crop. To be recommended.

Santa Rosa.—Well suited in every way ; tree quite thrifty and fair crops. To be recommended.

Splendour.—Very heavy growth, well furnished. Desirable tree, but of shy fruiting-habit.

Victoria.—Very poor growth and no fruit. In no way suitable to locality.

Washington.—Tree of very heavy growth and small crop. Not very promising.

Peaches.

Peaches of the more successful varieties proved to be in quite congenial surroundings and have thriven well, with a disposition to rather overluxuriant wood-growth, which may result in a tree of comparatively short life, though their quick establishment and precocity of fruiting would make replacement easy and economic. Observations of varieties under test showed the following results :—

Golden Queen.—A desirable tree in every way ; good sturdy growth, well furnished, and bearing heavy crops.

Hale's Early.—Trees have succeeded well, and are of desirable growth, but crops very poor.

Kia Ora.—Not suited to locality; tree of very poor growth and very shy fruiting-habit.

Mayflower.—A desirable tree, but very shy in fruiting, and for this reason not to be recommended.

Osprey.—Very thrifty tree of good growing habit and heavy crop. To be recommended for planting.

Paragon.—A most desirable variety in every way; robust tree of constant cropping-habit. To be recommended.

Sneed.—Very poor growth and crop; not well suited to the locality.

Nectarines.

The limited number of varieties under test had much the same habit and adaptability as the peaches, and the most suitable ones could be just as confidently planted.

Gold-mine.—Exceptionally well suited and desirable in every way. To be recommended.

Nectarine Cardinal.—Tree of poor growth, with fruits of under-size and quality. Not well suited.

Victoria.—Tree of very desirable habit and crop; well suited to locality. To be recommended.

Apricots.

These were most disappointing. Varieties planted were Gooley, Newcastle, Oullin's Early, and Roxburgh Red. None of these were well suited. Little or no growth was made for several years, and the trees languished so far as to justify removal. This test confirms many experiences in the North that apricots do not succeed and are not a commercial proposition.

Summary.

A summary of the results shows that this locality is best suited for apples, plums, peaches, and nectarines in that order of merit, and to a lesser extent pears, while it is inadvisable to undertake the culture of apricots. Varieties which under trial demonstrated their marked suitability are as follows:—

Apples.
Albany Beauty.
Ballarat.
Celo.
Cox's Orange.
Dougherty.
Giant Jenneton.
Gravenstein.
Grannie Smith.
Stayman's Winesap.

Plums.
Doris.
Ngata.
Satsuma.
Santa Rosa.

Peaches.
Golden Queen.
Paragon.
Osprey.

Nectarines.
Gold-mine.
Victoria.

Pears.
P. Barry.
Williams Bon Chretien.

The writer acknowledges with thanks the wholehearted co-operation of Mr. F. G. Long, and his skilled attention to the cultural details of the test.

SEASONAL NOTES.

THE FARM.

PASTURE-MANAGEMENT.

OCTOBER is usually a somewhat critical period in the management of pastures. To get the best returns from pastures and from fertilizers which have been applied to them it is essential that the pastures be kept young—that is, characterized by vigorous leafy growth. Such leafy growth is desirable because the nutriment which it contains is in a very digestible form and occurs with the proportions of important ingredients well balanced to meet the requirements of milk-production of the cow and of the ewe.

The length of the period of leafy-growth production is reduced if pastures are allowed to become rank and to run to the development of flowering-stalks. In October in a normally favourable season there is a tendency for the pasture to develop too much growth unless this is properly guarded against. Last season this tendency was most marked on farms where top-dressing had been done for the first time or where the area top-dressed had been extended. On these farms the increased carrying-capacity resulting from the new or the additional top-dressing had been underestimated more often than overestimated, with the consequence that the extra growth could not, during early summer, be satisfactorily utilized by the stock carried, and there was a call for the adoption of practices specially to keep the pasture in check.

Fortunately the practices required for this purpose are definitely known and are in wide use in certain districts. The most important of these is proper handling of the grazing. Instead of allowing the stock to browse over the whole farm they should be concentrated into one paddock for a period sufficiently long to have the growth reduced to such an extent that to keep the stock in that paddock longer would mean that they would suffer. When this stage has been reached the stock should be transferred to another paddock which calls for similar treatment, and then in due course, in a similar way, to other paddocks until all available paddocks have been grazed over or until the growth in the paddock first grazed under this system has reached the stage when again it can be most advantageously grazed. At this stage another cycle of grazing over the paddocks in turn is commenced. If the rate of growth becomes so great that to graze all the paddocks would mean that some of them would become too rank for most advantageous grazing, then a paddock or paddocks providing growth in excess of the grazing-requirements should be dropped from the series of paddocks on which the rotational grazing is being practised. The paddocks so dropped from the rotational grazing series should be shut up for hay or ensilage production, which was referred to in the August *Journal*. Ensilage-making is specially dealt with elsewhere in this issue.

It may be that the growth of the pastures is found to be somewhat in excess of the grazing-requirements of the stock, and yet it is felt that no paddock can be safely dropped out of the grazing programme without submitting to the risk of being somewhat short of feed. A remedy for this position usually lies in further subdivision; often half a paddock could be dropped without risk when a whole paddock could not. Another remedy is to run the mower over any fields in which the whole or patches of the growth have run towards flower-head development. This is a practice which is known as "topping" the pastures, and in some districts into which it has been introduced only within comparatively recent times the

tendency is to delay the topping until it is far too late to obtain from it the full valuable effect it may have in prolonging the period of desirable young leafy production.

While the need for topping may occur on any fields which have not been sufficiently grazed, it is much more likely to occur on those which also have not been adequately harrowed. Indeed, on the latter, because of the development of rank, undesirable, unrelished growth round undisturbed animal-droppings, topping may be advisable even when grazing of the bulk of the field is reasonably close. Often when the topping is done at the right time, the bulk of the mown material which results is so small as not to justify gathering the material for hay or ensilage. It will be found that the wilting which such material undergoes after mowing results in the stock eating it much more readily than would be the case if it were not mown. Such wilted material may be utilized in this way, and with especial advantage if dry stock are available for so utilizing it. As yet farmers in general do not at all fully realize the need for preventing pastures becoming so mature that they pass beyond the vigorous fresh leafy non-woody stage which is so essential for the milk-production which is the foundation of the dairy and fat-lamb industries. The result is that at times farmers have plenty of feed on their pastures and yet their stock are suffering from lack of nourishment. The explanation lies in the fact that the feed available is not the kind required for the achievement of the purpose for which the stock is being kept. For instance, last season a herd was found to be unduly falling off in butterfat-production at the end of October although it was up to its knees in feed—the feed was already beyond the stage of maturity suited for milk-production. Such an instance is mentioned merely to illustrate the importance of attending to methods of grassland-management which assist in keeping the pastures young.

Fields which are to be used for hay-production this season and which have not as yet been shut up should be thoroughly harrowed after the final grazing before shutting up.

FORAGE CROPS.

The spread of knowledge of better methods of pasture-management and the more general adoption of these better methods have made many farmers less dependent than they had been upon special forage crops for their stock-feed requirements. In farming, as in other spheres, there are likely to arise tendencies to go from one extreme to the other, and instances come under notice which suggest that farmers at times go to extremes in the extent to which they depend upon their pastures alone and discard the assistance to the pastures which they could obtain from suitable special forage crops. By suitably using forage crops with pastures, often it would be possible to make the amount of feed available from month to month throughout a season conform better with the stock-feed requirements from month to month than is possible with well-managed pastures alone.

The cost of producing the better conformity which would result in this connection from suitable use of forage crops is the crux of the matter. Each farm has its own special features which must be considered, and so it is impossible to lay down rules which can be applied universally. However, two rules which are of fairly general application are of importance. In the first place, unless all the pastures of the farm are linked to such circumstances that it would be impossible to effect economic improvement by ploughing, then there is a strong probability that special forage crops will be well justified for some time. In the second place, if production of forage crops calls for no material increase in cost of labour or outlay in equipment over that required for ordinary farm routine work, then it is probable that production of appropriate forage crops is desirable. For instance, if a farmer can grow a few acres of forage crops, such as soft

turnips and mangels, mainly with the labour and equipment already on the farm, this fact is highly suggestive that such forage crops would be well worth while.

From these considerations it is clear that good pastures and pasture-management do not necessarily mean that forage crops fall in importance. Indeed, both in sheep-farming and in dairying, some of those who are most efficient as grassland farmers utilize forage crops to an important extent to assist towards the better utilization of their pastures.

Certain factors that beget ultimate success with forage crops require to be considered in October or soon afterwards. Important ones among these are :—

(1) Good cultivation is essential for a full measure of success with forage crops. Good seed, good land, and liberal use of high-grade fertilizers will be to some extent wasted if not linked with thorough cultivation. The extensive farm competitions in Taranaki have taught a valuable lesson in this respect which might well be taken to heart by all. During October much valuable preparatory cultivation can be carried out, weather permitting, which will tend to bring about the desirable good tilth that should be secured before seed is sown. On ground that it too wet, however, it is well to delay cultivation until drying has taken place, this applying in particular to heavy ground. If the soil readily clings to implements or to one's boots when walking over it, this may be taken as an indication that it is too wet to work without doing it harm. Deep as well as thorough cultivation of the seed-bed is essential ; if the soil is not cultivated deeply unfavourable conditions which may occur later on will be felt with greater severity.

(2) Earlier crops, which are relatively low in yield, are at times more desirable than heavier ones later on. For instance, a 20-ton-per-acre crop of turnips available to the dairy-farmer early in January may be more valuable than a 30-ton crop later on. Because of the special value of early crops at times it is occasionally advisable to sow a portion of a crop ahead of the time which is best for sowing from the viewpoint of yield and is therefore the season for sowing the main crop. For example, a first sowing of soft turnips and of rape can often be made with advantage in October, although the main crop would not be sown until November. When an early crop of soft turnips is desired a quickly maturing variety such as Red Paragon should be used at the first sowing.

(3) When crops are at their best for forage purposes only for a relatively short period, as, for instance, maize, millet, or cereals for green feed, then such crops, if it is desired to use them over a comparatively long period, should not be sown in one block. Rather a number of sowings should be made at suitable intervals, so that a succession of areas will come to the best stage for use at different dates during the period when the crop is required.

(4) With the increasing proportion of high-class permanent pasture which is becoming a feature of many farms, it becomes desirable to get as much growth as possible from the limited areas which it is deemed desirable to put under the plough for forage-crop purposes. On many farms now when land is ploughed the primary purpose is not, as was often the case in the past, to renovate pasture with the forage crop as a subsidiary consideration and a step towards a return to pasture. The primary purpose is the forage crop, and if this is kept in mind it becomes clear that every measure which profitably fosters high yield should be adopted in order to lessen the amount of ground it is necessary to break out of pasture. This means that liberal fertilizing and high-class seed, as well as the thorough cultivation already mentioned, are features to-day of successful forage-crop production.

—R. P. Connell, M.A., Fields Division, Palmerston North.

GUARDING AGAINST LOSSES OF LAMBS.

Every spring a good many losses occur among lambs, and these to a considerable extent can be avoided by the exercise of the best care and management.

First of all there is the trouble commonly known as "pulpy kidney," the victims of which are nearly always the best and fattest of the lambs, which die suddenly at from two to four weeks of age—most often between three and four weeks. At this age the lamb's supply of milk is being augmented by young grass with a high food value. As a consequence the lamb is actually receiving more food at this age than its internal organs can effectively deal with The lambs die very suddenly, as a rule, without showing any previous symptoms. Therefore, such preventive measures as are practicable require to be adopted if losses are to be reduced as far as possible.

The exercise involved in yarding up the lambs and the loss of blood from marking are as a rule measures which largely prevent this trouble. As the critical period depends on the age of the lamb, and this period is at the age of two to four weeks, exercise daily on a bare paddock is recommended during this period. It is often sufficient in small flocks to move the sheep from one end of the paddock to the other two or three times daily; but, however it is done, plenty of exercise is a most valuable precautionary measure.

A few lambs are lost annually from hæmorrhage, and from infection of the wounds at time of docking and marking. To prevent this any lamb found bleeding excessively after the operating should be again caught and the bleeding stump cauterized, but this should only be done when the bleeding is noticed to be excessive and prolonged. The losses from infection of the wounds caused by the operations can largely be prevented by using only a knife which has been sterilized by boiling water, and swabbing the wounds afterwards with a solution of some reliable antiseptic. A quantity of this should be within easy reach while the docking operations are being carried out.

Another cause of loss among lambs, the direct importance of which is apt to be overlooked or underestimated, is the mis-mothering of lambs at docking-time. Among small flocks this may not amount to much, but on bigger properties it must cause a considerable loss in the aggregate To prevent this, or to reduce it to a minimum, is a matter involving principally method and management in handling the ewes and lambs at the time of the operation, but every sheep-farmer should bear this point in mind.

—*Live-stock Division.*

THE ORCHARD.

CULTIVATION.

With pruning finished, cultivation commences as soon as the weather and the state of the land will permit. So much depends on good soil-conditions that it is only in exceptional cases that cultivation can be dispensed with for a time. To ease up in cultivation is perhaps the most wasteful practice in all farming operations, leading as it does to increased outlay in manures to supply what should have been stimulated by soil-aeration, to decreased returns due to loss of moisture checking development of fruit and wood, and to increased difficulty in controlling pests which breed in the weeds or in the undisturbed soil. The season during which cultivation can be done in the average orchard is so short that every opportunity should be taken to push on with this work. After the winter rains the surface will be more or less compacted, and in this condition the action of beneficial nitrifying bacteria is retarded. In producing and maintaining

a fine tilth greater oxygen-supplies are incorporated with the soil to the benefit of the trees and soil bacteria to which we are indebted for our fertility, the soil warms up earlier, and the growing season is lengthened. If the top few inches of soil are disturbed frequently the capillary passages through which moisture escapes will be broken, a covering or blanket of small soil-particles and still air is formed over the undisturbed area in which the roots are feeding, and the consequent accumulation becomes available for the tree's requirements. For economic working, the maximum amount of hand-work should be eliminated, and with this end in view all low limbs which interfere with cultivation should be pruned to enable the implements to be worked as close to the trunks as the roots will allow, for the quantity of fruit produced on these limbs will seldom compensate for the hand labour they entail.

The application of manure should not be further delayed.

SPRAYING.

With the advent of warmer weather the activities of orchard diseases increase and close adherence to the spray programme becomes imperative. No programme can be made applicable to all districts, and variations should be made to suit individual requirements. It is in this that the value of a diary is appreciated, and a record of the salient points of one season's spraying may make the difference between failure and success in the next season's operations.

In districts where black-spot is troublesome apples should receive one or sometimes two sprays prior to blossoming. The first is either lime-sulphur 1–10 or 1–15, or bordeaux 6–5–50, at green-tip and up to tight-cluster. The second application is usually lime-sulphur 1–40, when the flower-buds are showing pink on apples and tender varieties of pears; other pears may need a bordeaux 3–4–50 spray.

The next spray is due when the majority of the petals have fallen, and marks the commencement of codlin-moth control as well as being most important for fungoid diseases. Most varieties of apples may receive lime-sulphur 1–100, plus arsenate of lead 1½ lb. if in powder form or 3 lb. if in paste, Black Leaf 40, 1 pint milk of lime from lime equal in weight to the lead and spreader. Tender varieties of apples, such as Cox's, Dunn's, Jonathan, and Golden Russet, should have the lime-sulphur reduced to ½ or ¾ gallon per 100 and 4 lb. to 6 lb. of precipitated sulphur added. Some growers prefer dispensing with lime-sulphur and using precipitated sulphur, 10 lb. or 12 lb. per 100, and where trees are not vigorous this is a much safer spray. "Dry-mix" sulphur spray is increasing in favour with commercial growers, but where only small quantities are used it will probably be found cheaper to use one of the other forms of sulphur.

The arsenate of lead is a most important ingredient in the combined spray referred to, and delay in making the first application will be evident throughout the season. In an average season codlin-moth is probably the easiest pest to control, and a bad infestation, although usually attributed to inferior spray material, may be regarded as an indication of slipshod work or failing to apply the spray at the proper time. In the usual life-cycle of the moth the female is depositing her eggs during the blossoming-period, and if the necessary quantity of arsenate of lead is not waiting when the grub is hatched the latter soon buries itself safely in the young fruit. The approximate date of emergence of the moth may be ascertained by making frequent inspections under the old bark or in sheltered crevices in the trees for the silky white cocoons, and noting the development. They may be found in surprising numbers even in well-tended orchards. Given suitable weather conditions, laying commences within a few days after emergence, and the average time required for the eggs to hatch is approximately eleven days. As the emergence of all the first

flight of adults is not simultaneous the laying season may extend over a considerable period, and it is essential that a coating of spray should be kept on the fruit in readiness for each grub as it hatches.

When black aphis appears any affected trees should be sprayed with Black Leaf 40, 1 part to 800, with the addition of a little soap to improve the spread and increase the adhesiveness.

Spraying for brown-rot control will be continued when the blossoms are showing pink, using lime-sulphur 1–50. At petal-fall an application of self-boiled lime-sulphur, dry-mix, or other precipitated sulphur should be made and continued throughout the season, particularly when humid conditions prevail or after rain.

GRAFTING.

Grafting should be completed immediately. If delayed until the sap-flow in the stock is strong the best results are not always obtained, the dormant scions appearing to be drowned by the excessive supply. If the trees or scions are too far advanced for grafting, the trees may be cut down to the required height and left until the young growths have developed sufficiently to bud some time during summer.

Citrus-culture.

During the ensuing period cultivation and the annual overhaul of trees will receive first consideration. If weak bushy growth, which usually produces low-grade fruit, is allowed to remain in the centre of the trees, picking operations are interfered with, and there is always the temptation to do a little thinning while picking, thus interfering with routine work. If the thinning or pruning is done early the light growths are buried with the first ploughing and add humus to the soil, instead of remaining on the surface as a nuisance for a great part of the year if not picked up. In thinning care should be taken to avoid exposing hitherto sheltered bark to too great an extent, as this is liable to lead to sunburn and the consequent loss of limbs. Where ends of shoots have died back, due to frost injury or disease, a little discrimination in pruning will often avoid the bunched conditions of unsatisfactory growth consequent on injuries of this nature. If allowed to grow unchecked lemons are prone to develop an outer fringe of fairly dense growth, which chokes the inside wood and limits the fruit-carrying capacity. The best fruiting-wood is the crooked more or less horizontal shoots, and in pruning the vigorous upright growths should be removed or shortened to a suitable length to induce branching. If the outer growth is kept reasonably open the main limbs can be kept clothed with good fruiting-wood, but if the trees become dense this is soon rendered useless.

Ploughing should be completed before the surface dries out, otherwise the trees may be severely checked by disturbing or exposing the shallow roots. As citrus-trees have a shallow-rooting habit, all the surface under the trees should be frequently stirred to check the development of shallow roots and induce deeper action. This is a matter of some importance, for where cultivation is neglected wilting of the leaves or partial defoliation of the tree may occur during a dry season, resulting in loss of the succeeding crop.

Freshly planted trees are benefited by protection from sun and wind during the first summer. In exposed positions the usual method is to surround the tree with scrim or sacking supported by three stakes driven into the ground about 18 in. from the stem. In sheltered positions light bushy manuka or similar growth driven into the ground and tied together at the top affords useful protection.

Manuring can be proceeded with after ploughing and before disking or harrowing. For healthy trees which require something more in the nature

of general nourishment to maintain production than an active stimulant, blood-and-bone at the rate of about 4 lb. to 6 lb. according to the age of the tree will generally prove satisfactory. Trees which through heavy cropping or lack of cultivation have ceased to produce a satisfactory quantity of young wood and have turned yellow should be stimulated with nitrates. The soil should be worked and a small dressing of nitrate of soda or sulphate of ammonia applied as soon as growth commences, to be followed later by superphosphate or a complete manure. Where procurable, sheep-manure and dags make an excellent dressing, which can be applied as mulch during the summer and later ploughed under. Citrus-trees prefer their nitrogen in a bulky form, and any wool pieces in the manure improve the physical condition of the soil.

Where required for the control of scale insects and the removal of sooty mould or *Capnodium* from the foliage, spraying with oil emulsion 1–40 should be done when the young shoots have attained a length of about 3 or 4 in., followed by a second application about three weeks later if necessary. Spraying before the growth has commenced may result in serious defoliation. Where red scale is present oil spraying should receive particular attention to prevent serious injury to the tree.

To reduce the strain on the trees and check the production of coarse thick-skinned fruit all lemons should be harvested as soon as they are ready. For home use where only a small quantity of fruit is concerned it can be kept for months if carefully gathered and stored in a dry place and protected from strong draughts. Lightly smearing the fruit with vaseline will be an assistance, as also is covering the fruit in the cases with perfectly dry sand.

—G. H. McIndoe, Orchard Instructor, Auckland.

POULTRY-KEEPING.

CARE OF THE GROWING STOCK.

LATE-HATCHED chickens under ordinary circumstances are placed in stale quarters and runs, and have not the protection from hot weather which nature demands, but which chickens hatched at a cooler period do not require. The disadvantages of late hatching can be counteracted to a great extent by placing the chickens in a clean fresh run which has the advantage of being well shaded. It is a mistake to conclude that when the young birds have passed the brooder stage they may be left to scratch for their living, and to generally looked after themselves. It is at this time, indeed, that they demand every favourable condition if they are to develop to the best advantage. Too often they are turned into old quarters or some unsatisfactory building, with no proper provision for cooling off, because all the good houses are occupied by adult stock.

Not only should provision be made for thoroughly clean houses and runs for the growing birds, but, in addition, some hover arrangement should be provided which will give them the desired seclusion to which they have been accustomed. In this way the chickens will be discouraged from huddling in corners, as they invariably do if taken direct from a brooder to an open-fronted house where no special sleeping-quarters are provided. Huddling should be prevented at all costs, as the sweating thereby induced is a common cause of chill, and inevitable mortality. A good sleeping arrangement can be made by having the perches, three or four in number, arranged, say, 1 ft. from the ground, and a similar distance apart. These should be covered with grain-sacks, but care should be taken to keep the ends of the sacks about 3 in. above

ground-level to enable the chickens to secure the necessary fresh air. After the first few days, and as the chickens grow older, the spaces between the sacks should be gradually opened wider as a means of allowing any bad air to escape, and at the same time of effecting the hardening-off process by degrees. Care should be taken for the first night or two to see that the chickens go under the hover, and do not crowd in corners, as it is unusual for them to take shelter on their own account. Trouble may be minimized in this respect if the chickens are placed under the hover when it is dark. The corners of the house should be rounded off with fine-mesh wire netting, so that in the event of the chickens finding their way to the corners they will be prevented from crowding against the walls, which is often responsible for heavy mortality taking place. For bedding dry straw or chaff may be used. Grass hay should not be used for bedding down chickens of any age, as this is apt to heat and bring about a sweated condition. It is extremely important that chickens should not be compelled to sleep under damp or moist conditions.

A common trouble which usually affects chickens after they leave the heated brooder is an inflammation of the veins. It first makes its appearance in the hock-joints, which become discoloured, followed by a gangrenous swelling. In a few days the wings become affected in a similar manner, and later the neck and head swell. At this stage death is not far off. There is no cure for this trouble. It is merely a question of prevention by avoiding overcrowding, providing ample ventilation, keeping the quarters clean and dry, and, above all, checking everything that tends to create a moist atmosphere. In order to prevent dampness as far as possible, it is a good plan to place under the bedding-material a piece of ruberoid or similar material until such time as the chickens take to the perches.

Where possible the growing birds should be given a good range, as confined or hothouse-plant conditions do not tend to promote the development of healthy and robust stock. There is no better place for them than an orchard. Of course, reference is now made only to the young pullets and cockerels intended for future breeding purposes. Cockerels intended for the table should have their exercise curtailed, as a free range does not tend towards rapid flesh-formation.

It is important that the sexes be separated at an early age, and the cockerels removed before they commence to crow. This will be to the advantage of the pullets, and will enable the cockerels to attain a desirable table condition earlier. The aim of the poultry-keeper should be to raise only vigorous stock. Good feeding, absolute cleanliness, and an ample supply of greenstuff, grit, and clean water are essentials to this end.

CANNIBALISTIC HABITS IN CHICKENS.

Almost daily I am being asked by correspondents for advice regarding chickens pecking each other. The cause of this trouble is difficult to determine, as it is common for the young birds to acquire the habit even when they are provided with good conditions and are under good management. The trouble may be minimized by giving the chickens pieces of tough meat to keep them running about. This, however, must be provided daily or not at all, for if they once acquire the taste for animal food and it is not available they are apt to crave for it, and as a result resort to pecking each other. When a regular supply of meat is not available it is a good plan to have a high-grade brand of meat-meal in front of the birds at all times for them to peck at during the brooder stage. As a further preventive of this trouble the chickens should be induced to exercise as much as possible by the provision of large-sized runs, or by making them scratch in fairly deep litter for their grain ration. An abundance of succulent green material will also do much towards minimizing cannibalistic

inclinations. The trouble is probably most common during bad-weather conditions, when the chickens have to be confined to the house. Especially does this apply where they have been accustomed to a run out-of-doors. At such a time the chickens will be discouraged from acquiring the habit if the open part at the front of the house is covered with some sort of curtain, in order that these quarters may be kept more or less in a state of semi-darkness. Generally it is the root of the tail and also the toes that are pecked at, and once blood makes its appearance from these parts the victim is apt to die a cruel death unless it is isolated from its mates. Sometimes the removal of the victim from the flock can be avoided by a light application of Stockholm tar to the affected parts, which will discourage its mates making further attacks. As is the case with practically all other troubles affecting chickens, prevention is the only real means of dealing with this one, and plenty of range as a means of inducing the birds to exercise is probably the chief essential.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

SEASONAL PREPARATIONS.

OCTOBER is perhaps the month when the apiarist can do most in helping his bees to work up to full strength in time for the main honey-flow. In the warmer parts of the country swarms may be looked for about the middle of the month, but in the Southern districts they will probably not appear until three or four weeks later. By 1st October, unless the weather for some weeks has been cold and wet, every hive should have been examined and its condition noted with regard to stores, population, and health.

No colony should be allowed to dwindle because it has not sufficient food to provide for the offspring of a prolific queen. Yet, on the other hand, some beekeepers prefer that all the old honey in the hive should be used up before the new season's flow commences. The food-supply of the hive is sometimes an exceedingly puzzling matter, as it varies considerably in accordance with the weather and the strength of the colony, and only periodical and systematic examination can settle the question as to whether all is well with the hives in this respect. No harm can be done by feeding good white-sugar syrup, but a hive which is starved in the spring will probably not recover its strength till the main honey-flow is nearly over. By the middle of October, under normal weather conditions, every hive should have at least four frames of sealed brood, and many will have more. Those that have fewer, unless their food-supply is very short, should be marked for requeening as soon as possible. The apiarist's endeavour should be to keep his colonies as even as possible, thereby obtaining a uniform surplus throughout the apiary.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the month to treat any cases of disease which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, everything depending on locality and weather conditions. In some districts it would be almost suicidal for the beekeeper to treat his bees in October; in others, where right conditions prevail, it may be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to ensure that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal feeding.

HIVING SWARMS.

In most text-books on beekeeping this kind of advice is given: "When a swarm settles into a cluster take a light box and shake the bees into it," &c. This advice is all right where the bees are accommodating enough to settle in a convenient position for the shaking process to be carried out. Unfortunately, in many cases bees get into positions whence it is impossible to dislodge them so easily. Sometimes they will settle on a small bush, and much of the cluster will be on the ground. In this case probably the best thing to do is to place the box over the cluster, and if the bees do not show much disposition to climb up into the box they may be persuaded to do so by the use of a little smoke. When they cluster in the centre of a prickly hedge the box should be placed on one side of the hedge, and the beekeeper should puff smoke from the other side of the hedge, and thereby drive the bees towards the box. In the event of the swarm taking possession of a fencing-post and clustering on it from top to bottom, as they occasionally do, the smoker must again be used, and in addition it is as well to brush the bees from each side of the post in turn into the swarm-box with the brush which is used for the frames at extracting-time.

The usual practice is to leave the box sheltered from the sun and covered with a sack near the place where the swarm settled. Where few hives are kept this may be done with impunity, but if other swarms are expected it is well to remove the box to the place where the colony is to stand permanently, otherwise the probabilities are that before the close of the day the box will be taken possession of by three or four other swarms—a matter of annoyance to the man who wishes to keep his swarms separate.

In every case a swarm should be attended to as soon as it settles. Many people are under the impression that swarms should be left undisturbed till nightfall, but this idea is an erroneous one. They should invariably be placed in the box as soon as possible after the cluster is formed, and put so that they are sheltered from the rays of the sun.

WATER-SUPPLY.

One of the most important of the minor details of apiculture is the provision of a constant water-supply for the purpose of assisting the bees in brood-rearing. Not only is it necessary to conserve the energy of the bees by having the water close at hand, but it is well to ensure that they do not prove a nuisance at taps, cattle-troughs, &c. From early spring till late autumn water is an absolute necessity to bees, and they will consume comparatively immense quantities in fine weather. It thus behoves the beekeeper to see that a liberal supply is always available. By establishing a drinking-fountain early in the season he will teach the bees where to go for supplies, and ensure their always seeking the same spot for water.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

TOMATOES AND SMALL FRUITS.

TOMATOES under glass will now be setting the lower bunches of fruit, and liquid manure may be given. Temperatures should be maintained, but high temperatures in bright weather are injurious unless ample ventilation is given. This is of special importance in Northern districts where mould fungus is prevalent. Any cultivation necessary now should be very shallow to avoid disturbing the roots. Suckering and training the plants will require close attention.

Plants for the outdoor crop should be making steady growth, and should be given more air in fine weather. Towards the end of the month they should be placed outside in scrim-covered cradles to be hardened off. This should be done with careful consideration of the weather conditions at the time, so that the plants do not receive a check. Negligence in this connection is a very common fault: the plants become blue and starved and take a long time to recover. With hardly any exception, plants at this stage would receive benefit from one or two applications of bordeaux spray for the prevention of fungus disease. The preparation of the land in which the young plants are to be grown should now be completed.

Egg-plants and peppers are rather more susceptible to low temperatures, and the plants should be grown on under glass, and prepared for planting out a week or two later than tomatoes.

As the strawberry-beds come into flower a dressing of nitrate of soda or sulphate of ammonia, 1 oz. to the square yard, will be beneficial. This is an attention from which most other kinds of small fruits would benefit at this stage. After working in the manure the strawberry-beds should be given a mulch of straw or such other material as may be available.

THE MARKET-GARDEN.

Thinning seedling crops and cultivation with the Dutch hoe in bright weather are operations of the first importance at the present season.

Cabbage, cauliflower, and lettuce plants recently set out should receive a dressing of nitrate of soda as soon as they are established; this may be repeated three or four weeks later.

As the winter crops of cabbage, broccoli, &c., are cleared, the ground should be prepared for the half-hardy crops of tomatoes, egg-plants, peppers, cucumbers, melons, marrows, pumpkins, and dwarf and runner beans. Many of these are sometimes raised in boxes under glass and pricked out into pots or punnets, so as to be well forward by the time for planting them out arrives. This method is a very valuable aid to early cropping.

There is an increasing demand for well-grown beetroot. The main crop should now be sown.

The early crops of potatoes, peas, &c., will be cleared during the month of December, and the land will then be available for autumn and winter crops of savoys, cauliflower, broccoli, leeks, and celery. In preparation for this planting seed-beds should now be sown. Sow thinly in good rich soil that will induce steady growth. Celery is usually raised in boxes and pricked out 2 in. apart. This plant is best raised in partial shade, and large quantities may be sown in drills in the open. In this case the plants should be wrenched a week or two before lifting them for planting out, by cutting the tap-roots 2 in. or so beneath the surface. In this manner fibrous roots are formed and the operation of transplanting is facilitated. For commercial purposes the Golden Self-blanching variety is the most profitable.

LAWNS AND GREENS.

Lawns and greens from now on will be making rapid growth, and will require mowing frequently to keep the turf in condition. Good well-mown lawns are one of the most pleasant and attractive features in a garden, and for a couple of months they will require regular attention in this respect if they are to look their best. For this work a sharp clean machine is necessary, and it should be properly set; every gardener should thoroughly understand the working and setting of this machine. It may be sharpened by turning it over, reversing the action of the cutting-cylinder, and feeding in emery powder and oil with a cloth as the cylinder is turned on the bed-plate. This has the effect of sharpening the knives on the cylinder as

well as the edge of the bed-plate, and maintains a proper adjustment. When sharpened the machine should be wiped clean and the gears replaced as before.

Tobacco-culture.

Although it is not advisable to take any great risks by putting tobacco-plants out in the field too soon, yet in order to economize harvesting and curing costs it is often desired to spread those operations over the full harvest period, especially where large crops as related to the equipment are concerned. To do this one must spread the *planting-period* instead of planting the whole crop at one time; in doing this early planting is preferable to planting out very late. In some well-drained and sheltered situations in the warmer districts a commencement may often be made during the month of October, and for this work both the plant-beds and the field will require some further preparation.

It is assumed that at this period the land has been deeply cultivated without bringing the subsoil to the top, and that frequent harrowing during the spring has destroyed seedling weeds, also that dressings of lime and fertilizers have been made and worked in. The further preparation for planting consists of levelling and smoothing the surface with a plant-drag, which will greatly facilitate the planting and other operations which follow. As cut-worms are sometimes a great pest to young plants, which are eaten off by these hungry larvæ whose natural food-plants have been destroyed, it is sometimes necessary to broadcast a poison bait to destroy them. The danger is greatest where grasslands have been broken in, and especially where the preparation has been late and quickly done. In such cases the bait should be broadcast a few days before planting, and towards the end of an afternoon, as these caterpillars chiefly feed at night. The bait is made of 1 lb. Paris green, 3 lb. treacle, and 1 bushel bran. Boil the Paris green in 1 gallon of water; pour the treacle into the boiling mixture, and stir well; then take it off the fire. Damp the bran with a little water, add it to the mixture, and stir well until all the ingredients are thoroughly distributed. Arsenate of lead, 2 lb., may be used instead of Paris green. This quantity is sufficient for 1 acre. It should be broadcast thinly in fine weather, and should rain interfere with its action the application must be repeated.

The further preparation of the early seed beds previous to trans-planting will consist of treatment with a view to hardening off the plants gradually without checking the growth. This may be done by removing the covers for an hour or two each morning, gradually lengthening the period until the plants are exposed all day, the covers being only replaced during the night. During this operation the plants should be kept on the dry side and only watered to prevent them wilting. The day before transplanting is commenced the bed should be well watered to enable the plants to be removed with as little damage as possible. The plants should be lifted with plenty of soil, and stood upright in trays for removal to the field. A good "take" in the field largely depends on the care given in hardening and transplanting the plants.

When planting out, the rows should be made in a north-and-south direction 4 ft. apart to allow room for working. An average distance between the plants is 2 ft., but this should be adjusted to suit the land; on a fertile soil they may be rather closer, to prevent the leaves growing coarse and rank. At the distances given it takes 5,000 plants to plant an acre. The usual method of planting is to strike out a furrow about 3 in. to 4 in. deep with a small hand-plough, using rods 4 ft. in length to indicate the line. As these rods are approached by the plough they are removed, the distance is measured, and the rod placed in position for the next line 4 ft. away. The planters follow and place each plant in the

furrow, and cover them firmly by drawing back the soil by hand. On the return trip of the plough the filling of the furrow is completed. The plants should be planted deeply and firmly, with the terminal bud slightly below the level of the soil, taking care that soil does not get into the bud of the plant.

No amount of care can compensate for a bad take at first setting, but to replace losses it is customary to plant every eighth row with plants 1 ft. apart. Then where gaps occur a hole is dug, and a spare plant is lifted with a shovel and set in the place with little damage. This method keeps the plants in the field as even as possible, which is most desirable, as an uneven crop is difficult to harvest properly. Replacement should not be made later than ten to fourteen days after planting, at which period the extra plants should be destroyed.

—W. C. Hyde, Horticulturist, Wellington.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1928–29.

Dairy Division.

LISTS of butter and cheese factories which have obtained for their export produce an average grade of 93 points or over for the past dairy-industry year—1st August, 1928, to 31st July, 1929—are here presented. Seventy-five butter-factories and thirty cheese-factories have gained a place in the lists this year, compared with sixty-nine and twenty respectively for 1927–28. The highest butter average this year is 95·412 points, as against 95·039 in the preceding year. The top cheese average is 94·473 points, compared with 93·755 in 1927–28.

Company or Proprietor.	Registered No.	Brand.	Average Grade Points.
Butter-factories.			
Taieri and Peninsula (Dunedin) ..	54	Taieri and Peninsula	95·412
Rangitikei	1360	Rangitikei ..	95·189
Rata	938	Rata	95·023
Levin	910	Lake	94·867
Wangaehu	1326	Wangaehu ..	94·832
Awahuri	664	Red Rose ..	94·707
Moa Farmers'	341	Inglewood ..	94·703
Golden Bay	146	Sovereign ..	94·632
Mangorei	345	Mangorei	94·520
Rongotea	8	Rongotea ..	94·473
Waitaki	812	Waitaki	94·350
United	1220	Whariti	94·336
Farmers' Dairy Federation (Invercargill)	336	Murihiku	94·335
Maketawa	342	M.D.C.	94·321
Shannon	1489	Shannon	94·291
Taieri and Peninsula (Oamaru)	1234	Taieri and Peninsula	94·291
Arahura	1516	Arahura	94·262
Midhirst	110	Rugby	94·228
Wairoa	1345	Wairoa	94·144
Tarurutangi	728	Champion	94·138
Tolaga Bay	1007	Tolaga Bay ..	94·104
Tikorangi	102	Shield	94·084
Rangiwahia	750	Quail	94·082

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1928–29—*continued.*

Company or Proprietor.	Registered No.	Brand.	Average Grade Points.
Butter-factories—*continued.*			
Uruti	300	Uruti	94·003
Lepperton	49	Lepperton	93·983
Kia Ora	926	Kia Ora	93·982
Waitara	726	Waitara	93·936
Kairanga	1768	Longburn	93·935
Invercargill	290	Rakiura	93·925
North Taranaki	723	Flax	93·914
Wellington Municipality	202	Rahui	93·906
New Zealand (Ngatea)	291	Anchor	93·896
Palm	1838	Palmerston	93·891
Farmers' Dairy Federation (Gore)	165	Gore	93·875
Tarata	631	Tarata	93·872
Okau	872	Okau	93·871
Norsewood	600	Norsewood	93·857
Pio Pio	603	Pio Pio	93·794
Cheltenham	3	Pakeha	93·746
Kuku	905	Ohau	93·746
Raetihi	717	Raetihi	93·737
Taihape	1188	Tikapu	93·723
Apiti	414	Apiti	93·712
Kokatahi	1144	Kokatahi	93·666
Tariki	1818	Tariki	93·648
Heretaunga	1230	Heretaunga, Temoe	93·637
Golden Coast	991	Golden Coast	93·614
Omata	82	Omata	93·578
Waipukurau	1455	Mount Vernon	93·518
Napier	169	Clive	93·507
Masterton	1307	Masterton	93·492
West Coast Farmers'	675	Silver Pine	93·446
Inter Wanganui	6	Inter Wanganui	93·408
Ngatiporou	395	Nati	93·400
Ruawai	66	Ruawai	93·378
Tamaki	1463	Tamaki	93·376
Bell Block	488	Bell Block	93·362
Kaikoura	302	Kai	93·351
Katikati	1305	Katikati	93·329
Stratford	68	Stratford	93·300
Murchison	1888	Airship	93·290
Konini	1203	Konini	93·282
Kaponga	732	Kaponga	93·273
Mauriceville	14	Mauriceville	93·225
Waimate	244	Waimate	93·146
Karamea	1570	Karamea	93·145
East Tamaki	301	East Tamaki	93·111
Kiwi	299	Kiwi	93·106
Caroline	236	Caroline	93·097
N.Z. Farmers' Dairy Union	100	Hinemoa	93·096
Kaipara	794	Poplar	93·072
Alpine	792	Pine	93·063
Maungaturoto	1407	Otamatea	93·059
Northern Wairoa	4	Hobson	93·015
Whakaronga	1709	Whakaronga	93·000
Cheese-factories.			
Kaiparoro	619	Bruce	94·473
Little Akaloa	32	Little Akaloa	94·154
Milton	1030	Milton	94·099
Omimi	74	Omimi	93·946
Waimana	1817	Waimana	93·931

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1928-29—*continued*.

Company or Proprietor.	Registered No.	Brand.	Average Grade Points
Cheese-factories *continued*.			
Carrington	621	Carrington	93·769
Woodville	1892	Woodville	93·745
Tamaki	58	Tamaki	93·733
Ryal Bush	477	Ryal Bush	93·653
Barry's Bay	401	Onawe	93·600
Brydone	1821	Brydone	93·560
Dalefield	9	Dalefield	93·548
Tamaki	1463	Tamaki	93·446
Belvedere	486	Belevedere	93·432
Wyndham	59	Wyndham	93·344
Pine Bush	543	Pine Bush	93·328
Taratahi	101	Taratahi	93·287
Hopelands	1178	Hopelands	93·272
Staveley	1719	Staveley	93·222
Momona	1010	Momona	93·215
Royal Oak	693	Royal Oak	93·188
Merton	45	Merton	93·134
Stirling	292	Stirling	93·117
Wright's Bush	206	Wright's Bush	93·116
Seaward Downs	702	Seaward Downs	93·111
Orari	254	Orari	93·093
Takamatua	33	Takamatua	93·073
Maungatua	1708	Maungatua	93·054
Waianiwa	1171	Waianiwa	93·045
Edendale	36	Pioneer	93·041

DOMINION TREASURE LASS (RUAKURA STATE FARM).

C.O.R. in Jersey junior two-year-old class: 11,302 lb. milk, 614·87 lb. butterfat.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FEEDING MOLASSES TO COWS.

"A.B.C.," Dannevirke:

I have been told that molasses is a good thing to mix with chaff for feeding cows, and should be glad to know the quantity to allow per cow and how to feed it. Would treacle deteriorate with age or develop any poisonous properties through being kept in a barrel for eight or ten years?

The Live-stock Division:—

Molasses is used for cattle, horses, and sheep, but only to a limited extent in New Zealand. As an addition to roughage it is given with the object of inducing the animals to eat the roughage, and especially in cases where the latter is not of the best quality. Molasses may be used with chaff for your cows. It is usual to dilute the molasses with water and spray it over the chaff. The quantity of molasses given per head per day can be gradually increased up to 2 lb. It is advisable, however, to commence with only ½ lb. per head per day until the cows become accustomed to it. It would not be advisable to use treacle which had been stored for such a long period as eight to ten years.

TOP-DRESSING CHEWINGS FESCUE.

D. J. H., Nightcaps:—

Can you give me information of what would be the best artificial manure for top-dressing Chewings fescue to make it throw up an abundance of seed-stalks? The fescue is growing on a stiff clay soil, and is not by any means a thick or close sole.

The Fields Division:—

It is rather doubtful if the application of manures to Chewings fescue would result in a payable increase. Usually a Chewings fescue pasture represents a certain soil fertility level much lower than that required for other pasture grasses, with perhaps the exception of ratstail and some of the danthonias. When manures are applied, the response is rather from higher-fertility-demanding grasses, clovers, &c. In a Chewings fescue pasture at Mossburn, top-dressed with 3 cwt. per acre of super, the increase from grass-growth was only slight, by no means payable, and such increase was mainly fog, crested dogstail, and suckling clover. If there is a fair clover content in your Chewings fescue the super, &c., would increase this rather than the Chewings fescue, give you more bulk to deal with, and it is very doubtful if the Chewings fescue increase would compensate you. If you are depending on grazing from the Chewings fescue aftermath, then it might be worth while, but rejuvenation by the plough when the Chewings fescue is running out is perhaps the best method.

WHITE TONGUE AND MARKINGS IN JERSEY CATTLE.

"GRATEFUL," Woodside:—

I have a purebred Jersey bull which is entered in the stud book, a beautiful animal in every detail, but with a white tongue. Is this a mark of degeneracy? The bull also has a white mark on the brisket. Has this any connection with the white tongue?

The Live-stock Division:—

White markings on the hair of purebred Jersey cattle are quite common, and so also are white tongues. Many of the purebreds in the Island of Jersey are thus marked, and judges here take no objection to them.

GROWING LUPINS FOR GREEN MANURING AND SEED.

"LUPIN," Awatata :—

I would like some information about the growing of lupins, both for seed and for green manuring. What time of the year they should be sown in Southland? Would a stiff clay soil suit them—say, after turnips were fed off? What manure should be used?

The Fields Division :—

Blue lupins will do excellently on clay soils. They should be sown in 7 in. drills at a depth of 1½ in. to 2 in. For green-manuring purposes lupins can be sown in Southland early in October. They commence to flower in about eleven or twelve weeks after sowing, and are ready to plough under when the pods are filling, usually a month later. Sow at the rate of 2½ bushels per acre, with 2 cwt. to 3 cwt. of superphosphate per acre. For a seed crop sowing should be done about the same time as for oats, to ensure harvesting operations being carried out in good weather. Sow at the rate of 1½ bushels per acre in 7 in. drills, using the same manure. The crop should be cut with the binder when the top pods are ripe. Stack the crop and allow it to mature for several months before threshing. Any ordinary threshing plant will deal effectively with lupins.

FOOT TROUBLE WITH SHEEP.

J. F. W., Hicks Bay :—

I would be grateful if you could give me a reliable remedy for scald in the feet of sheep. A good number of the ewes were bad in the autumn. I examined all their feet, pared them, &c., and put some of them, along with foot-rotty sheep, through a bath containing a proprietary foot-liquid. All the scalded ones are still bad, though they are running at the tops of my hills. All the foot-rotty ewes are cured

The Live-stock Division :—

There is no reason to believe that scald is different from foot-rot. Scald in sheep is generally the precursor to foot-rot, or it might be described as a mild form of foot-rot. Scald in the feet is frequently seen when sheep are grazing on rank grass, especially in wet seasons. Rational treatment for this complaint is the application of an astringent solution to harden the hoof, especially the interdigital space. A solution of copper sulphate (bluestone) in water is one of the safest and best astringents to use. If a small number of sheep are affected hand treatment can be carried out; if a number are affected a foot-bath, either wooden or concrete, is more suitable. Bluestone solution can be used at the rate of 4 oz. to 8 oz. to the gallon of water. Depending on the extent of the trouble, the foot should be kept in the solution from three to five minutes.

CULTIVATION OF ARTICHOKES.

HUGH ROSS, Waitomo Caves :—

Would you please give me particulars in regard to planting Jerusalem artichokes. Do they need deep cultivation? What is the best time for planting, and the right distance apart in the row?

The Fields Division :—

Artichokes do best on deep loams of light to medium texture; on the heavier and wetter types of soil the tubers do not keep well. The land should be ploughed in the late winter and worked up for planting in the spring. The easiest way to plant the tubers is to cross-plough, and plant the tubers in the furrows like potatoes. The tubers should be planted 3 in. deep, in rows 2 ft. to 2 ft. 6 in. apart, and 18 in. to 20 in. apart in the rows. The crop should be fertilized with 3 cwt. to 4 cwt. of superphosphate per acre. Towards the end of September would probably be the best time for planting in your district. Where the tubers planted are small it is best to plant two or three together, but one large tuber gives the best returns. The weight of tubers necessary to plant an acre is 12 cwt. to 15 cwt.

CHOU MOELLIER FOR SHEEP.

"X," Christchurch :—

I hear that chou moellier is largely replacing swedes in Southland. I have seen it growing in small quantities, but would like to know whether it can be fed to sheep other than by hand feeding, and, if so, at what stage of growth? When should it be planted, say, in North Canterbury, for feeding in July and August? How great is the danger of its being blown down by wind?

The Fields Division :—

A considerable area of chou moellier is grown in Southland as feed for both cows and sheep. It requires good land to produce a heavy crop, and takes at least six weeks longer to mature than rape. It can be fed in the same manner as rape or other like crops. If the crop is sown early in December it will be ready for feeding in the late autumn, but will keep in a satisfactory feeding condition until the end of July. The plant has a very strong root-system and is seldom blown down by gales.

PERMITS FOR KEEPING RABBITS.

In view of the number of Angora and Chinchilla rabbits now kept for industrial purposes, it should be generally known that any person keeping rabbits without a permit is liable to prosecution and a fine of up to £20. Hence, it is advisable for any one at present keeping rabbits without such a permit to communicate immediately with the Inspector of Stock at the nearest office of the Department of Agriculture. Circumstances point to the necessity for the Department enforcing this provision of the Act, and Inspectors throughout the Dominion are being instructed to report upon all cases where any one is found in possession of rabbits without a permit, with a view to legal proceedings being taken where the circumstances are such as to warrant that course.

INVENTIONS OF AGRICULTURAL INTEREST.

Applications for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 25th July to 5th September, 1929, include the following of agricultural interest :—

No. 60492 : Manure ; C. H. Robbins, Carterton. No. 62247 : Hoof cushioning pad ; A. V. Downie, Kensington, N.S.W. No. 62538 : Manure distributor ; A. Storrie, Auckland. No. 62928 : Grip for tractor wheel ; A. M. McGregor, Parkes, N.S.W. No. 62939 : Egg container ; J. H. Pickett, Hamilton, Ontario. No. 60332 : Support for cast sheep ; G. A. Bruce, Oxford. No. 60710 : Fibre-handling apparatus ; Maddren Bros., Ltd., Christchurch. No. 61138 : Gravity grader for fruit ; D. Knowles, Motueka. No. 61217 : Milking-machine pulsator : H. H. Sutton, Waihi. No. 61468 : Machine sheep-shear ; J. E. Ellis, Auckland. No. 62638 : Milking-machine pulsator ; C. A. Martin, Hamilton. No. 62815 . Milking-machine releaser ; J. Treloar, Hamilton. No. 62990 : Snail trap. N. J. Gilberd, Auckland. No. 63130 : Hemp bleaching ; Spectrum Dyes Pty., Ltd., Melbourne. No. 62134 : Horse cover ; J. Curry, Riversdale.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. prepaid.

Noxious Weeds Orders.—The Picton Borough Council has declared broom, fennel, and St. John's wort to be noxious weeds within the borough boundaries. The Green Island Borough has similarly declared all plants specified in the Second Schedule of the Noxious Weeds Act, 1928, and Rotorua Borough broom and gorse. The Amuri County Council has declared Californian thistle *not* to be a noxious weed within that county.

WEATHER RECORDS: AUGUST, 1929.

Dominion Meteorological Office.

GENERAL NOTES.

The weather in August was mainly a repetition of the unsettled type experienced during the previous month, with the additional disadvantage of more frequent strong winds, from both northerly and southerly directions. The monotony of unsettled conditions was, however, relieved by three intervals of fine weather associated with well-developed anticyclones. These fine spells covered the periods from the 1st to the 6th, from the 13th to the 15th, and from the 27th to the close of the month.

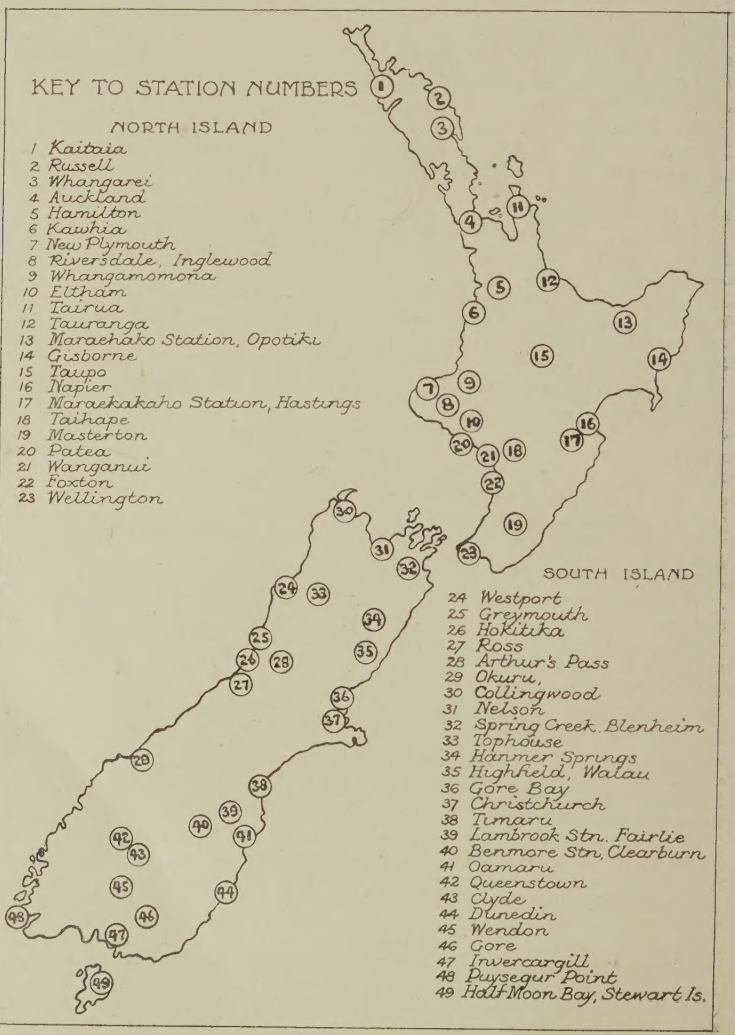
The differences from the average rainfall varied considerably, places in the same districts showing marked departures in opposite directions. For instance, Wellington City had 68 per cent. above the average, but Foxton 35 per cent. below; Timaru 11 per cent. above, and Oamaru 26 per cent. below; Hanmer Springs 138 per cent. above, and Christchurch 33 per cent. below. Westland recorded less than the average, as also did the greater part of Otago and Southland. Queenstown, however, had an excess. The Kaikoura district and the high country of the South Island had considerably more than the average. In the North Island, North Auckland and parts of the Gisborne, Hawke's Bay, and Taranaki districts had less than the normal fall, but the central area and places in the Wellington and Wanganui districts had more.

Temperatures were, on the whole, below normal, owing principally to the prolonged southerly spell from the 20th to the 27th, inclusive. Frosts were unusually numerous. Snowfall was even greater than in July in the mountain ranges of the South Island, and at some of the high-level sheep-stations snow-raking had to be resorted to. It is considered that there has not been so great an accumulation of snow in the mountains for about ten years. Although the growth of pasture was retarded somewhat by the cold temperatures it was not altogether checked, for in most districts sunshine was fairly abundant, and while the nights were cold they were compensated for by many mild days. Furthermore, though cold, conditions were seldom severe. Stock have kept in good condition, and lambing averages, so far, have been satisfactory. In some districts, such as the central portion of the North Island, the heavy rain has caused some mortality among the newly born lambs. The cold and wet conditions were detrimental, also, to the milk-supply from dairy herds.

The most generally unsettled weather was that which commenced about the 16th and continued until the 26th. By the 16th an anticyclone which had been covering New Zealand during the previous three days had passed eastwards, and an intense depression of the westerly type followed. During the night of the 16th and on the 17th heavy rain fell in the western districts, and north-west gales of exceptional force were experienced in and south of Cook Strait. Squally and unsettled conditions continued until the 19th. This particular depression contained three deep waves, the last of which passed over the Dominion on the 19th. On the day last mentioned there developed north-west of Cape Maria van Diemen a cyclone which proved to be the first of a series. These cyclones moved from west to east north of New Zealand, the last passing on the 26th. With one of them were associated the southerly gales of the 20th and 21st, during which heavy rain fell in many places in the North Island, and much flooding resulted in the Wairarapa, in parts of the Hutt Valley, and at Miramar.

Another storm, the effects of which, however, were less widespread, was associated with a cyclone which moved on to the North Island on the 7th.

Fairly general rain fell on this occasion, and during the night of the 7th, while the centre of the cyclone moved eastward from Auckland to beyond East Cape, conditions were particularly boisterous in the Hawke's Bay and Gisborne districts. East Cape had a thunderstorm and 5·25 in. of rain during this night.



RAINFALL FOR AUGUST, 1929, AT REPRESENTATIVE STATIONS.

Key No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	6·07	13	1·45	5·10
2	Russell	3·11	12	0·83	5·55
3	Whangarei	5·37	14	1·27	6·90
4	Auckland	4·89	16	1·22	4·19
5	Hamilton	5·74	14	1·83	4·02
5A	Rotorua	5·80	10	1·07	4·95
6	Kawhia	6·89	16	2·21	4·54
7	New Plymouth	3·13	15	0·51	5·33
8	Riversdale, Inglewood ..	5·89	17	0·95	8·65
9	Whangamomona	6·22	12	1·43	5·83
10	Eltham	4·61	14	1·02	3·82
11	Tairua	4·20	11	1·40	6·33
12	Tauranga	5·01	13	1·38	4·08
13	Maraehako Station, Opotiki	6·77	12	2·88	5·20
14	Gisborne	2·68	12	1·29	4·55
15	Taupo	4·24	10	0·97	4·06
16	Napier	2·81	12	0·98	3·57
17	Maraekakaho Station, Hastings	2·70	14	0·94	3·31
18	Taihape	2·92	17	0·92	2·73
19	Masterton	3·84	18	1·07	3·33
20	Patea	..	..	..	3·50
21	Wanganui	2·74	12	0·56	2·73
22	Foxton	1·88	7	0·52	2·89
23	Wellington (Karori Reservoir)	6·69	17	2·48	3·97
	South Island.				
24	Westport	3·96	20	0·53	6·27
25	Greymouth	5·29	12	1·20	7·53
26	Hokitika	6·56	14	1·46	9·34
27	Ross	9·83	10	1·96	10·40
28	Arthur's Pass	14·45	15	5·00	12·78
29	Okuru, Westland ..	4·76	7	1·54	11·46
30	Collingwood	1·14	5	0.45	6·96
31	Nelson	1·17	8	0·43	3·02
32	Spring Creek, Blenheim ..	..	..	..	2·73
33	Tophouse	5·14	12	0·85	4·64
34	Hanmer Springs	6·01	19	1·32	2·52
35	Highfield, Waiau ..	4·40	8	1·16	2·26
36	Gore Bay	2·68	6	0·85	2·12
37	Christchurch	1·22	8	0·51	1·83
38	Timaru	1·56	6	0·56	1·41
39	Lambrook Station, Fairlie	3·66	8	1·30	1·43
40	Benmore Station, Clearburn	2·52	10	0·88	1·45
41	Oamaru	1·27	6	0·46	1·71
42	Queenstown	3·43	11	1·30	1·93
43	Clyde	0·50	7	0·20	0·80
44	Dunedin	0·98	13	0·22	3·14
45	Wendon	1·03	7	0·50	2·26
46	Gore	1·65	15	0·56	2·31
47	Invercargill	2·86	15	0·50	3·31
48	Puysegur Point	5·43	21	0·61	7·20
49	Half-moon Bay	5·29	22	0·86	4·35

—*Edward Kidson, Director of Meteorological Services, Wellington, 6th September, 1929.*

CERTIFICATES ISSUED FOR SEED POTATOES.

FOLLOWING is a list of growers whose crops have been subjected to and passed the tuber inspection in connection with the system of Government certification of seed potatoes, during the month of August. A previous list was published in last month's *Journal*.

	Acreage.
Bresee's Prolific—	
James Carr, Mount Hutt, R.M.D., Rakaia	2
Endurance—	
R. G. Bishop, R.M.D., Southbridge	1
W. J. Bishop, "Rosedale," Southbridge	1
Dakota—	
James Carr, Mount Hutt, R.M.D., Rakaia	1
Doak Bros., West Belt, Rangiora	12
P. J. Gill, P.O. Box 11, Kirwee	1
Arran Chief—	
F. A. Rollinson and Sons, Studholme Junction	18
Golden Wonder—	
S. Kokay, Tuatapere	2½
King Edward—	
R. Knibbs, McNab, via Gore	1
Up-to-date—	
P. J. Gill, P.O. Box 11, Kirwee	1
Aucklander Short-top—	
J. Rouse, Pareora	1

AGRICULTURAL SHOWS, SEASON 1929-30.

THE following show-dates have been notified by agricultural and pastoral associations :—

Hawke's Bay A. and P. Society : Tomoana, 16th and 17th October, 1929.
Poverty Bay A. and P. Association : Jubilee Show, Gisborne, 22nd and 23rd October.
Wairarapa A. and P. Society : Carterton, 23rd and 24th October.
Timaru A. and P. Association : Timaru, 30th and 31st October.
Manawatu A. and P. Association : Palmerston North, 5th, 6th, and 7th November.
Northern A. and P. Association : Rangiora, 8th November.
Wanganui A. and P. Association : Wanganui, 13th and 14th November.
Waikato A. and P. Association : Claudelands, 13th and 14th November.
Canterbury A. and P. Association : Christchurch, 14th and 15th November.
Egmont A. and P. Association : Hawera, 20th and 21st November.
Nelson A. and P. Association : Richmond, 22nd and 23rd November.
Stratford A. and P. Association : Stratford, 27th and 28th November.
Southland A. and P. Association : **Royal Show**, Invercargill, 10th, 11th, and 12th December.
Helensville A. and P. Association : Helensville, 29th January, 1930.
Dannevirke A. and P. Association : Dannevirke, 11th and 12th February.
Tauranga A. and P. Association, Tauranga, 11th and 12th February.
Masterton A. and P. Association : Solway, 18th and 19th February.
Auckland A. and P. Association : Auckland, 27th and 28th February, and 1st March.
Taranaki Agricultural Society : New Plymouth, 5th and 6th March.

Testing Butter for Water Content.—The testing of export butter for moisture content was continued by the Dairy Division during the past year. A total of 142,934 churnings were tested, the average water content being 15·29 per cent., as against 15·19 for the preceding season. The number of churnings over the legal limit were much fewer than in 1927–28, the percentage of excess having been reduced from 0·873 to 0·059. These results are considered to be very satisfactory, and as reflecting credit on the butter-factory staffs.